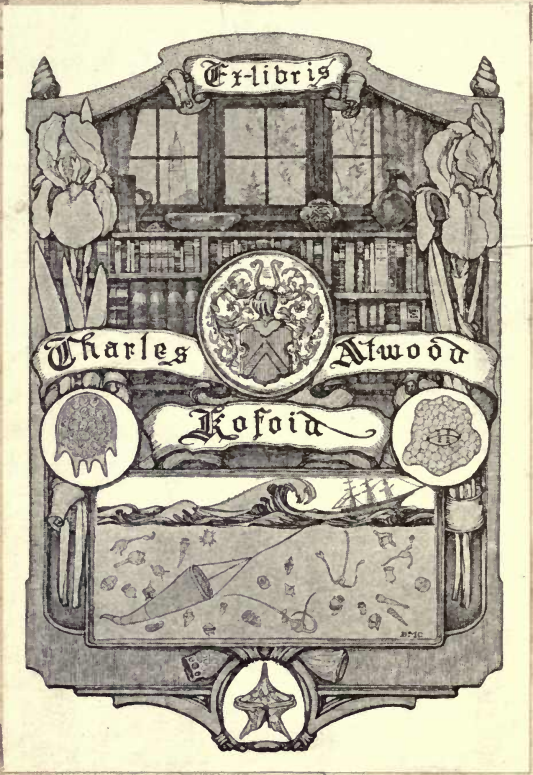

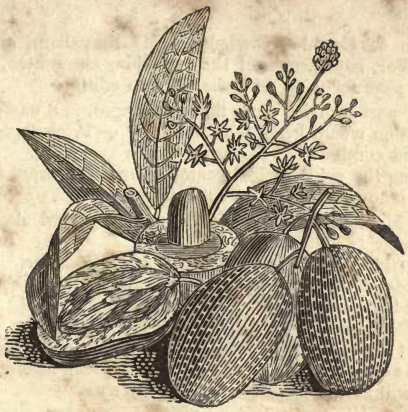

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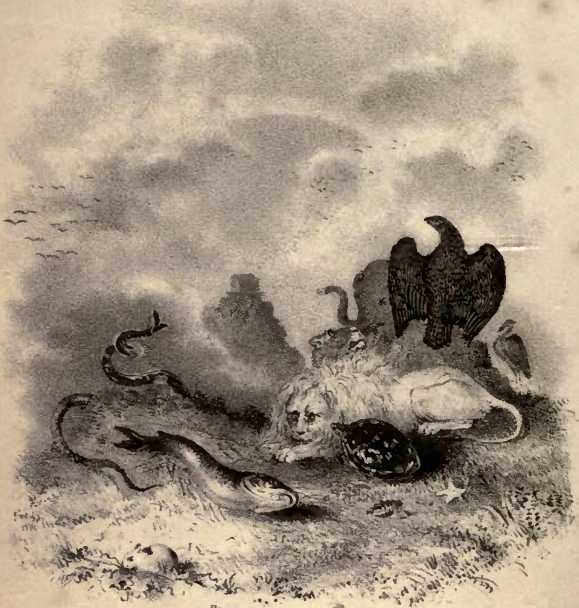
PRACTICAL NATURALIST.



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"As an Observer of Nature, every man has it in his power to become a Naturalist."

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MANUAL

OF THE

PRACTICAL NATURALIST;

OR

DIRECTIONS

FOR COLLECTING, PREPARING, AND PRESERVING

SUBJECTS OF

NATURAL HISTORY.

Containing instructions and recipes according to the most approved methods for taking and stuffing Quadrupeds, Birds, Fishes, Reptiles. Selecting, preserving, and arranging Ins ects, Minerals, Plants, Shells, &c, &c.

BOSTON—LILLY AND WAIT, AND CARTER, HENDEE & BABCOCK.

1831.

INTRODUCTION.

THE object of the present work is to afford the necessary instruction for preserving the various productions of nature, and to present a general idea of the arrangements with respect to family and species, upon which naturalists have established their methods of classification.

It is evident, that without any efficient means for the preservation of the various subjects which compose the three great departments of nature, natural science, so far from having made that immense progress which at the present day is the object of so much admiration, would be still shrouded in the deepest ignorance. The antelopes, the dolphins, the apes, and the phocæ of the animal creation, would maintain the charac-

ter imposed upon them by the uninstructed credulity of former ages, and figure to our imaginations as unicorns, tritons, fawns, satyrs and sirens. But the torch of science has enlightened a great portion of the globe; sober truth has exploded the extravagances of fiction, and a philosophical criticism occupies the place of wonder and credulity.

We owe this advantage to the study of Natural History;—a study which has been promoted chiefly by those admirable collections of materials for this department of knowledge in Europe; collections which have excited the admiration of every individual, and continue to hold out a further incitement to researches destined to tear aside the veil from what is still a mystery to our eyes.

The different branches of human knowledge advance by means of the reciprocal aid which they lend each other. No art but has afforded some discovery useful to the rest, and which they have applied to extend their own limits.

In our own infant country, and with that predominant bias toward the practical and useful, which is the characteristic of the present day, the science of Natural History is not without high claims to our notice.

Europe possesses museums of Natural History, the loss of which would throw back the science for a century. Ought not the citizen of this thriving republic to feel a wish to rival the old continent in these precious collections? It would be needless to expatiate upon the richness of the materials which our own land offers.

Although the knowledge which is imparted in these pages may not appear to enter immediately into the great interests of mankind, yet it is not the less worthy of occupying the attention of the friend of science. The enthusiastic admirer of nature will not fail to appreciate it. By means of this knowledge we are enabled to preserve animals for years after their death, in all those brilliant colours and graceful attitudes which con-

stitute their principal charm when living. By this help the studious naturalist may have under his own view the representatives of the various tribes which people the whole animal kingdom. Within the walls of his own cabinet he may compare together the tiger of India and the panther of America,—the enormous serpent who strives with the lion of the African deserts, and the torpid reptile that sluggishly 'drags its slow length along' in the bogs of Northern Europe. In the confines of his own study he will be able to correct the errors of the traveller who is seduced by the love of the marvellous; and treading in the steps of Buffon and Cuvier, will acquire greater treasures of knowledge in his closet, than thousands who traverse the world for study.

The works upon Natural History which our country has produced, are of high value to the science. The splendid volumes of Wilson and Bonaparte upon Ornithology, and of several other writers in different branches, are known with high reputation beyond the limits of our own country. A systematic collection of the various tribes of

animals indigenous to our continent, ought to occupy our first attention in the endeavour to promote this science. The recent formation in this city of a society of Natural History, leads us to hope that an undertaking of so much interest and usefulness to the study will soon receive the countenance and aid of the Boston public. Whoever has witnessed the admirable collection of the Museum of Natural History at Paris, must be sensible what a credit would be reflected upon the citizens of that portion of our country which could pride itself upon the possession of a similar treasury of scientific riches.

As an aid and exhortation in behalf of so desirable an object, the following manual has been prepared. To make it the more acceptable to the general reader, care has been taken to avoid or explain all the less common scientific terms.

The art of preparing animals with a view to their preservation is very ancient. The oldest civilized nation upon the globe possessed it in a high degree of perfection — a higher than even

that of the present day. The Egyptian mummies of human subjects, birds, cats, &c, of several thousand years' antiquity, have come down to us in perfect preservation. The Egyptian art, however, has been lost.

The modern art of preservation can date back but little more than half a century. Some English, French, and Swedish naturalists published treatises on the subject about the years 1750 and 1760. Those which attracted the most notice were the productions of Dr John Coakley Lettsom and the celebrated Reaumur. The latter formed a very beautiful cabinet of natural history in his own house, which after his death became the basis of the collection of birds in the Museum at Paris. Experience, however, proved that the means he proposed were insufficient for preservation. Reaumur received birds from all parts of the world, in spirit of wine, according to the instructions he had given, and contented himself with taking them from this liquor and arranging them in his cabinet with wires. The larger animals were padded with straw.

Some persons in France, struck with the appearance of these animals, attempted to skin some native birds, and to *mount* them for the cabinet. They succeeded but indifferently; the body was too forward, and the thighs projected out behind. It may be well to observe that this fault always happens with those who mount a bird for the first time, even when they have received proper instructions.

To these succeeded the German, Schœffer. This naturalist, after skinning them contented himself by cutting the birds longitudinally in two, and filling one half with plaster; then fixing the skin at the back of a box of a depth proportionate to the size of the bird, he stuck in an eye, and replaced or represented the beak and claws by painting; he then carefully fixed a glass on this frame, to protect the object from insects. This method is still followed in Germany, but much improved.

A work appeared at Lyons in 1758, entitled 'Instructions on the manner of Collecting and

Preparing the different Curiosities of Natural History.' M. Turgot, the author, was the first who announced some useful principles for the art. This work likewise contained a memoir of M. Duhamel, entitled 'Instructions for the transportation by sea of Living Plants, Seeds, &c.' The work is altogether an interesting one.

In 1786, the Abbé Manesse published a treatise on the 'Manner of Stuffing and Preserving Animals and Skins.' He presented his work to the Academy, who made a very favourable report of it. This book contained some very useful advice, but the instructions it gave for mounting and preserving birds do not appear altogether admissible. The author excludes the use of poisons, and in this we recognise the principles of humanity which have always characterized him.

The Abbé Manesse has rendered great service to science by his excellent observations on the manners of animals. He neglected no information which might be procured either by corre-

spondence or his own labours. At the age of forty-five he climbed the highest trees with the assistance of two hooks fitted to a pair of boots, and a girth which encircled his body and the tree at the same time.

M. Mauduyt has given a memoir on the manner of preparing birds for collections in the fifth livraison of the *Encyclopedie Methodique, Histoire Naturelle des Oiseaux.* He does not, however, point out any effectual means of preservation. His recommendation of sulphureous fumigations for killing insects, is liable to strong objections from the injury to which the skins themselves are exposed.

The English work of Dr Lettsom contains some judicious directions, and is valuable as far as it goes, but is much too concise for a safe guide. There had been previously written, although not published, a treatise upon the same subject by John Reinhold Forster, the traveller; of this work Dr Lettsom made considerable use in the

compilation of his own. The writings of Davis and Kuckahn, in the Philosophical Transactions, were also turned by him to the same account. Lettsom's 'Naturalist's and Traveller's Companion,' with all its deficiencies, may still be consulted with advantage.

Besides these, many small treatises were given to the world in various scientific journals and other shapes, among which number may be mentioned one by Linné. The Dutch had shown a great taste for birds, and had made four or five collections of much interest for the rarity of the species and the beautiful preparation of the individuals. An old sculptor at the Hague devoted himself to the practice of preparing skins, and in a short time surpassed all those who had attempted large animals, especially mammalia.

It does not appear, however, that either the Dutch or the English had published any work which treated of the mounting of animals according to system. The French had as little to offer

of their own, if we except the memoir of Mauduyt, which being inserted in an encyclopædia was not in a sufficiently popular shape,—and the work of the Abbé Manesse, whose tediousness frightened every student. Besides, the systems of both these writers were essentially faulty in the means they offered for the preservation of skins. The alkalies recommended by Manesse attract the dampness in moist seasons, and injure the feathers. The sulphureous fumigations of Mauduyt have the same bad effect in many instances. Up to the beginning of the present century, a general want was felt for a systematic work, which should furnish a method of preserving and augmenting the various Zoological collections, which the increasing taste for the study of Natural History had brought together in many countries of Europe.

In 1802 this defect was nearly supplied; there appeared nearly at the same moment, two works on *Taxidermy* (the art of preparing skins); the one by M. Nicholas, a chemist, and the other by

M. Henon. M. Nicholas makes an analysis of all that had been previously written on the preparation of animals: this review comprehends nearly half the volume. Like the Abbé Manessse, he renounces poisons as dangerous to the preparers, and insufficient to avert the destructive effects of insects on zoological collections. He affirms, that with his soapy pomatum and tanning liquor, stuffed animals may be preserved a long time. The drugs which compose his preparations do not injure those who use them.

In the work of Henon and Mouton Fontenille, the authors had at first no other object than to read their manuscript to the Athenæum at Lyons, of which they were members; they were solicited to print it, and the work was published in 1802. These authors speak of birds only; they describe an infinity of methods practised by others, and compare them with their own, which without doubt are preferable, but too slow to satisfy the impatience of ornithologists.

Becœur, a skilful apothecary of Metz, may be said to have created the art of Taxidermy. The arsenical soap invented by him is the most valuable material hitherto known for the preservation of the skins of all animals. Many birds prepared by him sixty and seventy years ago, are still in beautiful preservation. His method of mounting both birds and quadrupeds, is one of the best hitherto made known.

The materials of the work which we now offer to the American reader, have been drawn from most of the sources indicated above; the treatise on the management of insects at the end of the work, we have taken from the instructions of the naturalist Donovan. Several other compilations in a popular shape have within a few years been collected from the same quarters. M. Boitard, an experienced French naturalist, has published a comprehensive and methodical treatise, entitled '*Manuel du Naturaliste Preparateur*,' which we have regarded as the most judicious in point of arrangement, and satisfactory in direction. We

have accordingly made it the basis of our performance,—adopting this author's general divisions of the subject, and adding to his own observations such remarks of others as were judged necessary to make the work complete in all its branches.

Boston, June 1831.

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PART II.

TAXIDERMY,

ON THE MANAGEMENT OF INSECTS,

MANUAL

OF THE

PRACTICAL NATURALIST.

PART I.

Of the Methods of procuring Objects of Natural History.

By a singular fatality, the greater portion of those who in any way turn their attention to Natural History, constantly neglect their native territories. An uncommon plant, or strange animal from India or Africa, has excited the interest of numbers among us, who pass by with indifference many a native production of equal importance. We are in many instances better acquainted with the animals of foreign lands, than with those which inhabit under our very eyes. A common error, which affects other departments of human conduct, may be designated as the cause. What is familiar to us and immediately within our reach, we are apt to regard as of inferior value to that which is of distant origin and difficult acquirement.

It is true, that the naturalist who is desirous of attaining a complete perfection in his study, should possess other qualities beside the knowledge of preserving such objects of his attention as chance or a mere desultory research may throw in his way. He who would be a thorough naturalist, and exhibit a true enthusiasm for the science, must indeed arm himself with patience, courage and resolution. He must visit foreign lands, and encounter the fatigues of distant voyages. There are treasures invaluable to science to be sought out among the burning plains of India, and the rugged mountains of the western world. These are worthy objects of a noble ambition, but the opportunity and means for the attempt are at the command of but a small number. But let not the lover of natural science despair if the means of prosecuting extensive researches are not within his power. All nature is full of life: and though it be his lot to find his endeavours circumscribed within the limits of his own country, he may still be enabled to make valuable discoveries, and render essential service to that branch of knowledge which it is his ambition to promote.

OF TAKING BIRDS.

No one is ignorant of that important direction which constitutes the first item in the celebrated

recipe for cooking a turbot. It may be expected of us, therefore, before we speak of stuffing the bird, to give some special directions how to *catch* him. Trusting, however, that the reader has anticipated us on this point, we shall pass over the subject of guns and traps as supererogatory, and only remark, that as regards our present purpose, the method is indifferent.

In whatever manner it is performed, the operator should furnish himself with a pair of pincers, paper, cotton, flax or clean tow, and plaster of Paris in powder. Should the weather be hot, or the place of hunting distant, so as to hazard the spoiling of the game ere it can be sent home, have a tin box containing nettle, mint, and such aromatic plants as grow on the banks of rivers; in this pack the birds, after preparing them as we shall presently direct. This is recommended as a sure method by M. Boitard, who alleges in its favour an experience of more than twenty years in Italy and the south of France, where from the heat of the climate corruption in ordinary cases takes place in a few hours.

When a bird is shot, secure him immediately, that he may not soil his feathers with the blood of the wound. Seek out the wound, and raise the feathers which cover it. Put a quantity of the powdered plaster* upon the wound, and

* In these cases, when plaster is not to be had, you may substitute dry earth, ashes, or bran.

thrust into it a plug of cotton ; then add more of the plaster, and when the bleeding is quite stanched, replace the feathers. Cleanse the mouth and stop it with the tow or cotton, introducing a quantity of plaster. This precaution must be particularly observed in the case of birds of prey, as they often disgorge their food in dying, and sometimes after death. The nostrils also should be plugged with cotton, on account of the fetid matter which commonly escapes therefrom ; in the vulture this matter is so strong in odour, that when the feathers become imbued with it, nothing can remove the scent. In performing the operation, care should be taken not to distort the nostrils or the corners of the mouth, as in many species of birds these points indicate generical or specific characters.

If it be a bird feeding upon fish, such as the pelican or heron, cleanse not only the throat but the crop and pouch, for the least pressure would force out their contents and soil the plumage. To empty the pouch of a pelican, you have only to open his beak and take out the contents with the hand. In a bird without a pouch, the process although longer, has hardly more difficulty:—hang him up by the claws with the head downwards, shake him, and squeeze the neck with a gentle pressure, passing from the breast down to the mouth ; this will force out the contents of

the stomach. After this, stuff his mouth with plaster and cotton as above directed. The escape of the excrement is prevented in the same way.

This is the moment when the naturalist should make the following indispensable observations. Open his eyes and take exact note of their colour;—measure his extreme length from the point of the beak to the end of the tail;—and, if you have had opportunity before shooting him of observing his attitude, note it down, that when he is stuffed he may be placed in the same position. These observations may consist chiefly of the following.

1. Does he perch,* or otherwise?

2. Are his thighs† bare, or hidden by the plumage of the belly?

3. Is his body while at rest placed vertically, obliquely, or horizontally?

4. Are the wings drawn up, or hanging down?—Do they cross over the tail?—Are they confounded and united with the feathers of the breast and back for a third, one-half, or two-thirds of their length from the top?—Do their tips reach

* To *perch*, in the language of ornithology, is to follow the habit of alighting on a branch or rail, in contradistinction to alighting on the ground or any flat surface: Thus a robin perches, a duck does not.

† In the present instance, the word *thigh* is used in the popular application. The scientific nomenclature gives another name to this limb of the bird.

to the end of the tail? or half its length? or a quarter? &c.

5. What is the exact colour of the claws,—beak,—ceres,—and glands?

These remarks, although they may appear unnecessarily minute, yet are very essential. One example out of a thousand will suffice. Suppose you have shot a young male or old female *cresserelle*;* the most exact description will not enable you to distinguish it from a female *cresserellette*, unless you note the precise length, which is two inches longer in the first mentioned bird: or unless the wings and tail be compared, as the wings in the cresserelle reach but three-fourths the length of the tail. These are the only clear distinctions of the two species.

Having followed the above directions, hold the bird by the bill, and shake him gently to get rid of the superfluous plaster, and return the feathers to their natural position; in aid of this you may blow upon him, but always in the direction of the feathers: then roll up a sheet of strong paper into a cone, and place him head first within, taking care not to derange the feathers, it being extremely difficult afterwards to replace them properly: the legs should be stretched along the tail, and the wings placed close: then close up

* The *Kestrel* of Buffon, the *Stannel* or *Wind-Hover* of others. *Falco tinnunculus* of Gmelin.

the package, after placing within the notes you have taken respecting the bird; then put it carefully in a box or bag, and if you have several of these packages put the largest at the bottom.

When you take a bird in a snare or net, be careful in killing him that he does not beat his feathers off in struggling; seize him by the two fingers under the wings, between the breast and the belly, and pinch him till he is suffocated. Taking with nets is a tolerable method of obtaining small birds in good condition, but requires a degree of skill which is only attained by long practice. Its success too is hardly certain, except during the spring; when, in the season of pairing, the feathered tribe lose their timidity and allow themselves to be approached.

Many interesting subjects are sometimes taken by birdlime, but they are often quite spoiled by this substance. Nevertheless, if a bird taken in this manner have saved enough of his plumage to render him worth preserving, and his rarity make it an object, he may with care and patience be cleansed, thus:—Rub the limed feathers with fresh butter till the lime and butter coalesce, which you may know by the mixture's not sticking; remove as much as you can scrape off with a knife, and wash the remainder with a strong solution of potash; the lime being removed, wash again with clear water and dry it with powdered

plaster. For want of potash, make a strong ley of equal parts of ashes and water; let it stand twenty-four hours, and decant it clear. If neither of these lotions be procurable, you may use very strong soap-suds several times renewed.

Some persons, after applying the butter to the limed feathers, add a quantity of ether, and afterwards wipe the feathers dry with tow. This is doubtless the most expeditious way, but has the disadvantage of discolouring the plumage.

In addition to the above methods of procuring subjects, there is another which is by no means to be neglected; this is, to go to the markets where game is sold. But ere you purchase a bird, however valuable he may appear, satisfy yourself that he is capable of preservation. Examine first the claws, the bill, and the large beam-feathers of the wings and tail. If none of these are wanting, see whether the skull be not broken, as many persons crush with the hand the heads of those birds which they take in nets, or, when shooting, finish them by beating their heads; in these cases, the bones of the head being fractured, it will be difficult to restore it to its true shape, and with any care it could not be arranged with firmness. Still, in the case of a very rare subject, these circumstances will not detract wholly from its value.

Examine moreover whether the flesh be sufficiently free from putrefaction to preserve the

feathers upon the skin in the process of flaying. This you cannot always know by the smell, for the wound will sometimes exhale an odour which infects no other part. Examine attentively the small feathers at the corners of the bill and the cheeks ; if they hold firmly, the bird is capable of preservation, but if you can rub off these feathers with the finger, and the skin beneath feels damp, abandon him as unfit for your purpose ; he would part with his plumage or come quite to pieces the moment you attempted to take off the skin.

Much attention is requisite in the selection of birds ; upon this depends the freshness and brilliancy of colour, which gives them their greatest value. A bird reared in a cage loses his gracefulness, the beauty of his dress, and sometimes the characteristics of his species. It is only upon the summit of the craggy rock, that we find the enormous bird of prey armed with his long and sharp talons. It is upon the sandy shores of the ocean or the banks of rivers, that we must look for the feathered combatants armed with a splendid cuirass of long and slender plumes; the woodpecker and the sparrow are decked in the gaudy dress of the pairing-season, solely when they inhabit the solitude of the forest. The naturalist therefore will not make his selections either from the barn-yard, or the aviary of the bird-fancier. Nature must be studied in the fields.

The nomenclature of birds is at present thrown into much confusion, by the errors of writers who have mistaken young individuals, females, and old males of a single class, for different species. Men of high talent, Buffon himself, cannot be exempted from this imputation. This great naturalist has given the name of *faucon* to the *falco peregrinus* of Gmelin;—he has made one species of the full-grown male; a second species of the young male, which he has named *faucon sors;* a third species of the year-old male, which he has called *faucon noir passager;* and a fourth species of the very old male, which has received from him the title of *lanier.* An intelligent amateur should employ all the means in his power to collect every variety of age and sex, as well as that variety occasioned by moulting. He who in this manner is enabled to make the acquisition of a whole genus, has rendered a true service to the study; his cabinet will possess more value in the eyes of a naturalist, than if he had heaped together thousands of individuals, rare in themselves, but isolated in respect to classification.

Birds of prey in general, and particularly those of the hawk kind (genus *falco*), deserve the first attention of the naturalist; next follow those which frequent the shores of the sea and

the banks of rivers; afterwards those of the *passer* tribe.*

OF TAKING MAMMIFEROUS ANIMALS.†

No one is ignorant of the manner of hunting mammiferous animals, such as the wolf, bear, fox, &c, but the industry of sportsmen has never been exercised upon small game, like dormice, field-mice, and the rest of the same tribe; in consequence, their history is confused, little known, and sufficient of course to establish the reputation of any one who will devote himself to the study of it exclusively. Common as these animals are in our forests, they are extremely rare in scientific collections. They may be shot with a fowling-piece during the evening twilight, upon the skirts of woods, near the fruit-trees which are scattered about those places; at this hour the dormice and squirrels profit by the last rays of the sun, to quit their holes and skip from branch to branch in quest of food; the weasel, ermine and polecat glide silently among the thickets in search of the lark, who has gone

* The sixth order of birds, according to the Linnæan system, comprising all the singing-birds.

† Animals which nourish their young by giving suck, are termed *mammiferous*.

to rest in the fields. They may also be taken in trap-cages, similar to those used for birds—with this difference, that wire or sheet-iron is to be substituted for wood; the trap may be baited with nuts and fruit of various sorts.

If the animal be large, he will require no preparation previous to skinning, for which process we refer the reader to a subsequent chapter. But if it be a small creature, or if his long and shining fur appear in danger from staining, as that of the ermine for example, stanch the bleeding, plug up the wounds with cotton or tow, and apply the pulverized plaster in abundance till the whole be dry; stop up in the same manner the mouth, ears, nostrils, and all openings of the body, to hinder the flow of blood, and the extravasation of the matter contained in the stomach and intestines. If it be necessary to preserve him a long time before he can be skinned, you may do this by a method which has always been found successful:—Open the belly, and take out the intestines and other viscera; fill the cavity with powdered charcoal; then making the body as clean and dry as possible, put a thick layer of charcoal-dust in a box and place the animal within; add more of the charcoal and cover him entirely, so that he may be completely surrounded, and no part touch the side of the box; then pack the whole snug, that nothing

may be deranged during conveyance from place to place.

Game packed in this manner may be kept fresh three months, but no air must be admitted for an instant during this time; otherwise whatever care you may exert in replacing it, the flesh will speedily corrupt.

The smallest quadrupeds may be kept for years by only putting them in spirit, taking care to keep them entirely submerged.

For those who have opportunities of procuring rare animals *alive*, in foreign countries, it may be of service to remark, that the younger animals are, the easier it is to accustom them to live in their cages. They will at first require particular care, and must always be nourished some weeks on shore before they are embarked. You cannot take too much pains to tame them. An animal who is not frightened at the sight of those who attend him, is always better, and more able to resist the fatigues of a voyage than when he remains wild; and there is scarcely any animal which we cannot tame by good treatment. An excess of food, when animals are shut up and not able to take exercise, is very injurious to them. The surest method of preserving them, is to give them only what is necessary. After this, the greatest requisite is cleanliness. It is

also necessary to take precautions that such animals be not worried by passengers.

OF TAKING REPTILES.

This class of beings comprehends two principal divisions; the first containing oviparous quadrupeds, frogs, lizards and tortoises, and the second, snakes. Each of these divisions offers to our researches, a different animal in respect to manners, shape, and locality of habitation; the method of hunting them is therefore dissimilar.

Frogs delight in marshes, ponds, and especially miry ditches. They are found in watery pastures, and upon roads after rain, or when a sultry and close air prognosticates a storm. You may seek for them with good success in stony places overgrown with wood, in the clefts of rocks, and the trunks of old trees; sometimes they will be found upon trees and in hedges, where they sit crouched upon leaves which they closely resemble in colour, and which cause them easily to escape notice.

Notwithstanding the vulgar notions respecting some of this tribe, particularly the toad, no species of them is venomous; and very singularly, the only one that offers any appearance of danger, is the one which is eaten. The skin of the

common frog exudes a viscous matter, sufficiently acrid to cause a painful smarting to the eyelids, if they happen to be rubbed by the hands which have touched one of these reptiles; but the danger extends no farther.

Most of the individuals of this class are clumsy in their movement, and cannot easily escape when you have once discovered their retreat. You may catch them with the hand without using any precaution; but those who cannot overcome their repugnance for these harmless creatures, may use leather gloves, or nippers made for the purpose. Some of the species of frogs, those in particular which haunt wet places, escape with a good deal of agility; these you may take with a small net stretched upon a hoop; they may also be caught with a hook and line, thus:—bait your hook (which should be very small,) with a grasshopper or other insect, or even with a bit of red cloth; draw it near the frog upon the surface of the water, or on the ground, taking care to keep it in motion like a living insect; many species of frogs may be drawn to a great distance by the view of this bait, and it is not uncommon to see a dozen at a time hopping after it and fighting among themselves for the bite. Some kinds are less voracious or more prudent, particularly toads; in presenting these with the bait, care must be taken not to frighten them; you must bring it to their

very mouths, in which case they can rarely resist the temptation.

With regard to tortoises, the persons who inhabit those places where they abound, are best acquainted with their haunts and the manner of taking them. Sea-tortoises are fond of those immense lagoons which are covered with a small depth of water, where they can feed upon the sea-weed and other marine productions growing in the sand at the bottom. Here you may harpoon them in your canoe; sometimes you may take them just as they are leaving the water to deposit their eggs upon the sand in the sunshine; at this time they are caught easily, and if there are many, turn them on their backs and they cannot escape. Land-tortoises are found in marshy places near the sea, and sometimes in the fresh water of ponds and rivers.

Lizards inhabit both land and water. Some kinds, as the crocodile, are dangerous from their size and the terrible power of their jaws, armed with long and sharp teeth; these you cannot master till you have shot them with a gun, or overpowered with clubs. Others of a small kind, like tritons and some species of salamanders, dwelling in marshes and ponds, may be caught easily with hooks or nets. A third class are found only in close and damp woody spots, among subterraneous ruins, and under rocks in

unfrequented places; among these are the land-salamanders which you may take without difficulty, as they are slow of movement, and have no means of escape or defence.

The most numerous class of lizards are those which inhabit the trunks of trees, old walls with a southerly exposure, slopes of ground with the same aspect, among fallen leaves, and in woody places not sufficiently grown to shade entirely the low shrubs and dead leaves, where they love to hide. These creatures are so quick in their motions, that the eye can scarcely trace their progress; in addition, they are courageous and snappish, and bite with their toothless jaws so firmly, that no method but killing will oblige them to loosen their hold; the wounds which they give, however, are not dangerous. Some of these little creatures are decked in the most brilliant colours; all are very difficult to catch; they must be taken by surprise or artifice, but the first method has the inconvenience almost always of mutilating them irreparably; their tail is extremely delicate, and broken by the slightest blow.

To catch this animal without injury, you must come upon him without being seen, and strike him with a flexible rod so as to hit him upon the back, just between his two pair of legs; thus breaking the back-bone, when you may secure

him without difficulty. Some of them have so keen a sight and smell, that it is almost impossible to surprise them; among these are the green and occellated lizard of the south of France. Take a very small hook, and attach it to a horse-hair line of three or four threads strongly twisted; bait this with a large fly, and hang it before the door of his dwelling; when he catches a view of it, he will not fail to bite.

Snakes should be hunted with precaution; some of an enormous size, which inhabit the burning plains of Africa, attack and conquer powerful animals by the aid of their prodigious strength and courage. It is particularly in hot climates that we find those species the most valuable for their rarity and splendid colours. Cold and temperate countries possess but few. The viper has the upper-jaw armed with one, two, three, and four moveable fangs, which closely resemble the claws of a cat; these fangs have a hollow through the whole of their length, by which the poison is conveyed into the wound. The bite is not commonly mortal; but in many circumstances may become so, especially if the person bitten be not of a robust temperament and healthy blood. Remedies should be promptly applied; the most sure is volatile alkali (sal volatile), a few drops of which should be swallowed in a glass of water; rub also the wound with

the same, and bind on a linen cloth dipped therein.

It would be serviceable here to specify the characters which distinguish the venomous snakes from the harmless, but unfortunately these marks are not sufficiently striking to catch the view at first sight;—at any rate, beware of the serpent with a triangular head, flat at the top, wide toward the body, and with a narrow neck. These reptiles often sleep stretched out upon rocks in the sun, or upon dry leaves; if you surprise them at this moment, you may be sure their first movement will be to bite or attempt an escape. It seems as if nature, in furnishing them with the most terrible of all weapons, had withheld the privilege of abusing them; for every noxious species is so slow of movement, as to be unable to inflict a bite except by surprise. From the moment you have discovered them, it is quite easy either to shun or attack them with advantage; they are too clumsy to spring upon you, and hardly able to escape by flight.

They should be managed with precaution, not only alive but dead. Serious results have followed the imprudence of persons who have scratched themselves with the fangs of a rattlesnake, dead and dry for several years. There are instances of persons dangerously bitten by the head of a viper, which had been separated

from the trunk more than forty-eight hours. Again you must be on your guard, when you have taken one apparently dead; these creatures, when they find themselves hotly pursued and without the means of escape, have the cunning to lie still and counterfeit death; wo to the rash mortal who trusts the deception!

Snakes are fond of rocky and woody spots, lying open during most of the day to the sun, and in the neighbourhood of a marsh or river, whither they go in hot weather to hunt the frogs, shrew-mice, and little birds. Some, not content with occasional visits to the banks of rivers, take up their abode there among the stumps and bushes; others keep about the rocks, among the ruins of old buildings, and even in the dunghills of yards little frequented. Every country and village has its particular locality, where they are most abundant; the inhabitants entertain too much dread of these reptiles, to be ignorant of the precise spots.

Upon setting out in pursuit of them, provide yourself with a pair of long-handled nippers or tongs, a leather sack in which you should sprinkle a quantity of snuff, and a net of the following make:—It should be a dip-net with very small meshes, or of a substance sufficiently transparent to enable you to see what is inclosed; the upper edge of the hoop to which the net is attached must be set with a row of sharp iron teeth, half

an inch long, and not above a quarter of an inch apart; to the hoop attach a handle three or four feet long, obliquely joining the hoop, so that you may hold the mouth of the net flat upon the ground without bringing the handle to a level. With this you may hold the reptile, whether snake or lizard, secure upon the ground; the teeth will prevent his escape underneath, if he be wholly within the circumference of the hoop; and if he be partly without, he will be fast pinned to the earth. In both cases, it will be easy to kill him without tearing the skin. Throw him into your sack, where the snuff will despatch him if he be not previously dead. In the same sack you may put your frogs, toads, lizards, &c.

They may then undergo the following preparation. Wash them in water several times, and extract the contents of the stomach; you may judge of the quantity of these, by the stuffed and prominent condition of the belly. It is well known that a snake no bigger round than the finger, and with a head of the size of the thumb, will swallow a toad as big as the fist; this surprising voracity is owing to the singular conformation of his jaws, whose elastic ligaments permit the enormous distention. When you find a snake's belly stuffed to this degree, hold him up by the tail, and with the other hand squeeze the swallowed mass downward to the mouth, where

commonly it will stop; then placing him on a table, force open his jaws by prying within them strongly and repeatedly; when his throat is widely distended, you may draw out the mass by a corkscrew attached to a long handle; after this, wash him again, and dry him by the frequent application of a cloth; you may then put him in spirits.

The best liquor for preserving not only reptiles, but all other subjects for Natural History, without doubt is alcohol or spirits of wine, as this is in no danger of freezing; still it has some disadvantages;—in the first place, it is costly; secondly, it is apt to discolour the subjects when too strong (the proper strength may be fixed at the 18th or 20th degree of Baumé's areometer); in the third place, it quickly evaporates when the vessel is not hermetically sealed. In the course of this work we shall give the composition of several liquors, which in many cases may be advantageously substituted. Every sort of alcohol is alike useful for the present purpose, whether manufactured from wine, the peach, potato, grain, or molasses.

If you design to keep a subject in liquor for a great length of time, let it first saturate therein a day or two; then take it out, and wipe off the mucosity which has gathered upon it; after which, put it in fresh liquor. Without this in-

dispensable precaution, the fluids of the animal will unite with the spirit, and weaken it to such a degree that the whole will be unable to preserve it from corruption.

In concluding this part, we may remind the young naturalist who wishes to collect reptiles, that the months of May and June are the best for his purpose; at this time the greater part have cast their slough, and appear in colours much more brilliant than at any later period.

OF TAKING FISH.

It will be needless to go into details upon this subject; every land has a class of people who make it an occupation. The naturalist, instead of furnishing himself with the whole train of implements necessary for the business, will find it more advantageous to procure from the fishermen whatever they may acquire worthy of his notice.

Fresh-water fish are easily obtained; with those of the sea it is different; most of the art that can be exerted in this department, consists in profiting by the occasions which mere hazard offers. There are few fishermen upon the sea-coast who do not at times, especially after a long or violent storm, find in their nets some individual of a tribe altogether unknown. If you could

establish a regular correspondence with a number of these persons at different places, you may be certain of receiving unquestionable rarities. No branch of natural history has made slower advances than this,—for the simple reason, that the method just recommended has been very rarely employed, although it happens to be the only one which can lead to any satisfactory results. 'I have a striking instance,' observes M. Boitard, 'within my own knowledge. A friend of mine made a journey four years ago to Marseilles, where, upon the most frequented part of the coast of France, there was little apparent chance of any new discovery; he found means to engage a fisherman in his employ, who since that time has transmitted him various subjects altogether unknown to the Museum of Natural History at Paris.'

The only preliminary preparation necessary to a fish, is to wipe off the slimy matter from the scales, and dry him by the frequent application of a cloth. He may then be put in liquor as above directed of reptiles.

OF TAKING CRUSTACEOUS ANIMALS.*

Most of these dwell in the water; few are

* That class, chiefly aquatic, which are covered with a semi-calcareous crust, and are furnished with jaws, feeders and eyes; thus a lobster is a crustaceous animal.

found at a distance from it, save some species of crabs. The greater number inhabit shallows, and rocks covered by the sea; some in rivers, springs and brooks; all of them are carnivorous, and feed upon the dead carcasses of other animals.

The land species should be sought for in moist woody places, on the slopes of mountains, in the trunks of old trees, in the clefts of rocks, and concealed in thick bushes; but always as before remarked, in the neighbourhood of the sea, they being obliged to resort thither to lay their eggs. They march commonly in troops; so that upon meeting with an individual, you may be sure by looking further to discover many more.

Those of the salt and those of fresh water have nearly the same habits, and are consequently taken in the same way. Procure an iron-hoop, larger or smaller according to the size of the species you are fishing for; attach a net to its circumference, and furnish it with a long handle; bait the net with a piece of meat, and if you want the marine species, place it under the surface in the mouth of a small stream when the tide is coming in; if the river species be your object, sink it near a clump of roots or a heap of stones, in a cool, clear, running stream; after a few hours raise it, and you will find it covered with the objects of your search.

Some of them have the custom of hiding themselves in a shell. The cancellus, and the rest of the same kind, are soft in the lower parts, and unable to resist the slightest blow; these have the habit of seeking out a univalve shell and bestowing themselves safely within, leaving exposed nothing but the head and their formidable claws, kept upon the watch for the small insects which constitute their food; the slightest alarm will drive them to these retreats; they drag them about wherever they go, and abandon them only when their bodies grow too big for their covering, at which time they cast them off and seek larger ones. The value of these when they are taken, consists in the shell; they should in consequence be caught together, and not separated.

Some individuals of the crab kind, too weak to resist their numerous enemies, creep into the shell of an oyster or a muscle, where they dwell in perfect harmony with the owner; the intruder thus provides himself with an impregnable fortress, but which does not allow him the perfect liberty of going in and out at pleasure; to exercise this privilege, the crab must wait till the oyster opens his shell to take a sup of water. This kind will not be found in the water; you must look for them in the shells of bivalvular fish, at certain seasons known to fishermen.

Those of a larger size, as lobsters, generally

follow the tide as it rises, and at ebb remain caught in the weirs of the fishermen ; they are abundant, and you will commonly have no difficulty but in making a choice.

Finally, the naturalist should leave no recess unexplored; rocks, cavities in the mud and roots, either upon the sea-shore or in the beds of rivers, the sea-weed, the sand—all these places upon a close scrutiny will recompense his researches.

Some authors recommend these subjects to be dried in the sun, or in an oven or stove, and thus preserved by covering them with varnish ; but this is a bad method, even when designed merely for temporary preservation ; it blackens the shell, causes an unpleasant odour, and attracts insects who destroy the muscles of the joints, and the animal falls to pieces. If you wish to keep a subject for a few days previous to commencing a preparation, keep him alive. Have a box or basket of double his width; fill it half-full with sea-weed, moss, or other marine plants, fresh from the water; put the animal within, and cover him with the same ; add a second animal, and another layer of plants ; proceed thus till you have filled two-thirds of your box ; then fill up with the plants and press the whole tightly down, so that the animals without being crushed may be hindered from leaving their places ; pour

on salt-water, and cover the box;—in this way you may keep them alive at least fifteen days.

If they are to be kept longer than this before preparation, or the weather be too hot, you must put them in spirits like reptiles.

Use particular care in your choice of the crustaceous tribe; they are all subject to the loss of their claws, and although these are quickly reproduced, the new ones are smaller than the first, which inequality hurts their looks. You will of course select those without this deformity; still if it happens that in the whole number before you, not one has both claws alike, they are not to be wholly rejected, as there exist species which never exhibit the claws perfectly equal.

All seasons are not equally favourable for taking them; at a certain time of the year they change their shell, and appear in new and more splendid colours; this is the proper period, although you must be careful that the new covering has grown sufficiently hard, which requires about fifteen days.

The entomostraceous tribe form a numerous division of the crustaceous order; these little animals are found in springs and running brooks of clear water, and in ponds under the stones and sand at the bottom; they have singular shapes, but their semi-pellucid bodies are so delicate, that in the space of half an hour they dry up,

and lose their shape, colour and transparency. They are interesting from their having yet received little notice. You may catch them with the nets used for insects; keep them in a phial of spirits of wine of fourteen degrees, otherwise they will quickly spoil.

OF TAKING INSECTS.

We shall treat this subject in many of its details, as it furnishes the only means by which the amateur can complete his collection; the traders in these commodities have only those of the largest kind; their perfect preservation requiring minute attention, and causing a great expenditure of time; add to which, the necessary knowledge of insects is difficult to acquire.

Upon commencing the business, you must be furnished with several implements which require a pretty exact description. These are—a box with pins, a butterfly-net, a net for aquatic insects, a pair of net-nippers for insects with a sting, and a large-mouthed phial of brandy or alcohol.

The box is of thick pasteboard or thin deal; the length and breadth are indifferent, but the depth should be 2½ inches within; the bottom is covered with a sheet of cork two or three

lines* in thickness, the cover of the box is lined with the same; add a ball, with fifty pins or more. If you cannot buy a sheet of cork to your mind, you may manufacture it, thus: — Select a piece sufficiently compact, without being too hard; let it be light, and as little porous as possible; if out of shape, you may flatten it by heating it till the hand can hardly bear it, when you must press it under a board and load it with a weight for three or four days; with a fine saw you can then cut it into sheets, which you will polish with a rasp and pumice-stone; glue these sheets of cork within the box, and a smaller piece upon the outside to pin the insect upon the moment he is taken, that you may have both hands free to handle the box.

If you are seeking for chrysalises, live caterpillars and bugs, two smaller boxes are necessary; a common pine-box will serve for the first; the caterpillars and bugs require one of a particular construction: — make this of very thin wood, and divide it into small compartments; each caterpillar, or at least each species, should have its separate place, — some are enemies to others, and will attack and destroy them; in the cover over each apartment, make a hole as big as a cent; cover this with a thin but strong cloth,

* The *line* is the twelfth part of an inch.

which will admit the air; bugs are powerful enough sometimes to eat through the cloth: a very fine wire net would be an advantageous substitute.

The box first mentioned, destined for the keeping of dead subjects, should have fastened in one corner a small piece of camphor covered with a cloth; this will suffice to keep off devouring vermin. Others recommend for the same purpose, a sprinkling of the essence of wild thyme.

The two other boxes should contain no odorous substance, nor even be kept near the first; caterpillars are extremely delicate, and killed by the slightest exhalation.

Some choice is necessary in the selection of pins; their size should be proportioned to the size and strength of the insect that is to be stuck upon the cork. When you are catching them, use a small rather than a large pin; as when you take away the pin to fix him finally in your collection, the new pin should quite fill up the hole made by the first, and be firmly attached to the animal.*

The nippers are indispensable, both for catching those with stings and placing them upon the cork.

* Pins made expressly for this purpose, are sold at the *Maison à l'Y* upon the Quai St Michel at Paris.

The butterfly-net is made thus:—Take an iron wire stiff enough to handle, bend it into a circle of 9 or 10 inches diameter and weld the ends together, leaving a portion sufficient to fasten into a socket of iron or copper, which you may screw, when wanted, upon a handle as long as a walking-stick; attach to this hoop a net of gauze with the stiffening removed, or other fine net-work, the net may be a foot or 18 inches deep. With this you may catch butterflies and many other insects; move it from left to right horizontally till it *bellies* or swells full; then cast it over the insect, and immediately bring the hoop perpendicular,—this movement shuts him completely in.

The net for aquatic insects is much like the former, and by means of the socket screws upon the same handle; the hoop must be stronger, and instead of being circular should be triangular; the net of strong and transparent gauze, the longer the better; with this you may fish in shallow ponds, ditches and small streams; stagnant waters exposed to the sun, will afford the most successful fishing.

Both these nets are also employed advantageously in another method, called by the French *faucher* (mowing); in meadows and other places overgrown with thick grass, drag the net along

close to the ground, shaking into it such insects as come in the way.

Spread a table-cloth or large sheet under a bush or tree, and beat the branches; the insects will fall into the cloth. You may supply the place of the cloth by an umbrella, which you hold inverted with the left hand while you strike the branches with the right. This was the method of the naturalist Bosc.

The net-nippers are like a pair of scissors or curling-tongs, the jaws making a sort of cage of wire; when an insect with a sting has alighted upon a flower, nip him flower and all within it,—you may then stick a pin through him without danger.

Into the phial above-mentioned put the coleopterous* tribes, and those insects whose dull colours are in no danger of spoiling.

Butterflies are of two sorts, those of the day and those of the night: the former appear only during the daytime, and should be sought only in the hottest hours. They may be caught upon the flowers on the skirts of forests, in meadows and pastures among clover—especially during the flowery season, in gardens, and upon such plants or trunks of trees as have nourished the caterpillars which produced them.

* Those insects which have wings with hard cases;—a beetle is *coleopterous*.

The *mars changeant* is found only upon poplar-trees; many other kinds inhabit only those places near which they were produced.

Having caught a butterfly in your net, kill him immediately, lest he beat his colours off or his wings to pieces in attempting to escape,—for it is well known that his gaudy tints consist in a fine dust, which the slightest touch will rub off; —to effect this, seize the net in the middle with the left hand, and with the right gently force him downward; then seize and pinch him with the thumb and fore-finger by the neck, under the wings, bringing them together over his back; as soon as he is still, stick him through the neck with a pin and fasten him upon the cork of your box.

Some sorts are very tenacious of life, and are not to be killed by this method; such you must stick through the breast, below the insertion of the wings, otherwise they cannot be kept still. The small and slender sorts dry very quick; and if they are kept too long in the box, the wings cannot be placed in a proper attitude unless care has been taken to fix them in this manner at first.

Night-butterflies come abroad only after dark, and would be difficult to take by the method above specified. Look for them in shady and dark places, upon the bark of old trees, walls

and rocks ; they are in a state of perfect torpidity, and you may take them by the mere thrust of a pin ; this manœuvre however demands a degree of dexterity, for if you miss your thrust the pin slips by him and he is off; when you are not confident of sticking him, you had better first cover him with the net.

The greater part of the moth species keep all day under the leaves, among thick bushes and hedges, invisible to the eye ; you must beat the bushes for these with a stick, and ply your net. When the air is calm and the night dark, place a light in a low, bare place, and you will quickly have a swarm of them around it.

Most caterpillars lurk among the lowest herbage in the night, begin to ascend early in the morning, and about noon are found feeding on the tops of their respective plants ; they descend gradually as the sun declines, and at the close of the evening are again concealed in the low herbage ;—night-feeders ascend in the evening, and descend as morning approaches.

In collecting insects, you should pay a proper attention to the weather. If it be pleasant, and the sun emits much warmth, insects are very brisk ; but in a cold or windy day, it will be a fruitless toil to attempt collecting them ; as all insects at such times shelter within the herbage, and instead of flying upward as usual when dis-

turbed, they dart into the thickest of the underwood,—or if once they rise above the bushes, they are impetuously hurled by the wind far beyond the reach of the fowling-net.

For the smaller kinds of lepidopterous insects, the best time is before sunrise or after sunset, though many may be taken by beating the bushes in the daytime. The best time to catch moths on the wing is during the night, especially an hour or two after sunset.

At daybreak many insects are on the wing; and most kinds are observed in hot weather to come forth after rain to enjoy the humidity of the air, which is then damp but warm. This is the best time for collecting, as their wings are less liable to stiffen before they can be set.

The males of some species of the moth tribe, by a remarkable faculty, are able to discover the females at a great distance and in the most secret situations. The male insects may be discovered by this means:—enclose the living female in a breeding-box, and place it near the usual haunt of the species; the males will soon be seen fluttering round the box, and endeavouring to gain admittance. This experiment is generally practised with success on the fox and egger moths.

Every species has a distinct time for its appearance, and this punctuality is scarcely forwarded or

retarded a few days, except by the unusual mildness or inclemency of the season; if you discover a brood of insects at a certain time of the year, precisely or nearly at the same period of the year following, you will find a brood of the same species.

Certain spots of ground and particular situations should always be noticed; these are the haunts of particular sorts; some kinds are confined to one certain spot, and are not to be found in any other part of the same wood or field;—thus having once discovered the haunt of an insect, you may be able every season to take some of that species. Some kinds have two or more broods every summer.

OF TAKING SHELL-FISH.

The greater number of these are found in the water, either fresh or salt, others dwell upon land; they form therefore three classes, river, sea, and land shell-fish.

The first inhabit rivers, brooks, ponds and lakes; they float upon the surface, or lie upon the gravel and sand at the bottom; some adhere to the rushes, roots and stones on the edge of the water. You may take them with the net for

aquatic insects above described, or seek them in the beds of dried up marshes.

The sea species are more difficult to procure, their habitations being the rocks and sand under water. Look for them when the tide is out, in places where the sand is worn into furrows and holes; wherever you see water spirting out, or air-bubbles rising, you may be sure of finding more or less by digging a little with a spade or hoe. Sometimes the animal lies buried a foot and a half, or two feet deep. Some dig into wood, stone, and the hardest substances, which must be broken to pieces to get at them.

To fish for these animals, make a net like that for aquatic insects, but larger, and with the bag of twine instead of cloth; the mouth of the net at the outer side of the triangle, must be set with teeth like a rake; you draw this along the bottom of the sea, the teeth loosen the shell-fish, and they pass into the net; this may be done in a boat, two persons rowing while a third manages the net. Where the water is too deep for this, use grappling irons of the common sort; these should be set upon a triangle of iron, with the edges sharp and sloping.

Upon sea voyages, the best thing you can do is to follow the advice of M. Bosc, and examine carefully the heaps of seaweed which have been torn up from the bottom of the ocean, and drift

before the wind; these often furnish us with shell-fish that dwell no where but in the deepest parts of the sea. The able naturalist just mentioned, had a custom of opening all the fish and birds which were taken during the voyage,—a species of research often attended with success.

The shelly tribes of the land are most generally found in damp and shady places, under moss and thick bushes, about the bark of trees, near the edge of the water, or under stones. The best time for them is the spring, after a warm and soft shower. Take with you a small leather bag for the larger kind, and a large-mouthed bottle for those of a more delicate and fragile construction.

In all cases take none but the live ones; the shells found empty, and which the traders in these articles call *dead*, must be rejected by the naturalist,—for however brilliant their appearance, you cannot be certain they possess their true colours; besides this, they will be often found bruised, and thereby deprived of some of their distinctive marks, especially about the neck; such shells have no value.

Molluscous animals without shells, and worms, are found wherever shell-fish inhabit. Intestinal worms are to be sought for in the viscera of animals; in the liver, the intestines, the lungs, brain, &c. This branch of natural history has been little

cultivated, and offers a field for many useful discoveries, particularly in relation to medicine.—Keep these in spirits of wine.

OF TAKING ZOOPHYTES.*

These oddly-shaped animals resemble sometimes a vegetable, a flower, a mushroom, a star, a chestnut in the shell, &c. They grow generally in the sea,—very seldom in fresh water. Those which are soft should be kept in spirits of wine; some are hard enough to dry and keep in a box. Those of a flat shape should be put immediately between two sheets of paper and rolled up; without this precaution, they will crisp in drying and lose their natural shape, which is that of a palm branch or feather.

CORALS, &c.

Some kinds of corallines, &c, must be washed first in spirits of wine, to kill the insects which are concealed in the hollows,—then in common water. White corallines, when dirty or changed

* Zoophytes are those anomalous productions which partake both of animal and vegetable organization.—The *five-finger*, which grows upon our wharves and on the rocks of the sea-coast, is a zoophyte.

black, may be cleansed by a mixture of soap-suds and pearlash, rubbing them with a soft brush; the finest degree of whiteness may be regained by this process. Fumigations of sulphur will also whiten coral that has been turned black.

POLYPES.

You may often observe at the bottoms of shallow pools, or on the plants which grow in or recline on the surface of water nearly stagnant, a number of small transparent lumps, about the size of a pea, and flattened on one side; these are polypes in an inactive state; they are generally fixed by one end to some solid substance—at the other end is an opening which is the mouth of the creature, and the arms shoot forth round it in the form of rays. They are generally found in waters that move gently; neither rapid streams, or pools utterly stagnant, ever abound with them; they adhere to aquatic plants, rotten wood, stones, &c. They are seldom met with in winter; but in May they begin to appear, and are found in ditches all the summer.

When you search for polypes, it will be best to take up a quantity of the pieces of wood, &c, that are usually found in ditches; put them into

a glass of water, and let it stand for a while without being moved; and if there are any polypes adhering to these substances, you will perceive them stretching out their arms in search for their prey.

These little animals may be fed upon worms, water-fleas, insects, the larvæ of gnats, and even butchers' meat, if cut small enough. To preserve them in health, it will be proper to change the water in which they are kept, very frequently, and particularly after they have done eating; the water must be poured off, the polypes taken out, and the sides and bottom of the glass washed free from any slimy sediment. In taking them out, first loosen their tails from the glass, and take them up separately with a quill cut in the shape of a scoop.

The power of reproduction in these creatures is most surprising. If you cut one of them transversely or longitudinally, in a little time each part will become a perfect individual; even a small portion of the skin will produce a new creature.

If you slit a polypus from the head to the middle of the body, an animal will be formed with two heads; and he will eat with both at the same time. If you slit him into six or seven parts, he becomes a hydra with as many heads; divide these, and he will have twelve or four-

teen; if these be severed from the trunk, as many new ones will spring up in their place,—and the heads thus deprived of their body will become new polypes.

OF COLLECTING SEEDS AND PLANTS.

The collection of a great number of rare plants, ought not to be considered as an object of mere luxury or curiosity. It is useful to the progress of science. We must not forget that several foreign plants, which are now spread in many parts, were first cultivated in botanical gardens.

Every one knows, that the coffee of America, which is now so great an article of commerce, proceeded from a plant raised in the greenhouses of Europe.

Seeds. To be certain of the maturity of seeds, you must gather them when they easily separate from the plant. In many instances you may take the branch which bears them, that those which are not perfectly ripe may become so. The bags containing the grains, well dried, ought to be put into a case covered with pitch,—to keep them from the damp, insects and mice.

The oily grains lose their germinating faculty soonest. The seeds of tea, coffee, and the glands of most of the oaks are of this kind. When you

collect these in foreign countries, they should be put into sandy earth:—strew a depth of two inches of it at the bottom of a box, and range the grains in the earth at distances equal to their size; cover them with about an inch of earth, add a fresh layer of seeds, and proceed in this way till within a foot of the top of the box; take care that the box be quite full of sand, that nothing may derange the seeds; cover the box, but in such a manner that the air may penetrate; make an opening at the top, which cover with a trellis of brass wire, to admit the air, but not the mice or other animals.

The grains germinate during the passage, and on arrival they should be immediately put into a proper soil.

M. de Candolle recommends to pack all seeds collected in a moist country or season, in charcoal. Honey is also said to be a good preservative.

According to the advice of Dr Lettsom, and other naturalists, the following directions will be found efficient.

Roll each seed in a coat of beeswax, half an inch thick; put a number of these into a box, and fill it up with melted wax; rub the outside of the box with Smith's liquid (hereafter described), to keep off the insects, and place it during the voyage in a cool, airy place. In this manner,

tea-seeds, the stones of mangoes, and all hard nuts and leguminous seeds in general, may be prepared.

Or they may be inclosed in paper or cotton, which has been first steeped in melted wax; and then placed in layers in a box, which is to be filled with melted wax as before. Pulpy seeds, as those of strawberries, mulberries, arbutuses, &c, may be squeezed together and dried, and then put into the cerate paper or cotton as above.

Small seeds, well dried, may be mixed with dry sand, put into the cerate paper or cotton, and packed in glass bottles, well corked and covered with bladder or leather. These bottles may be put into a keg or box filled with the following mixture:—4 parts of common salt, 2 of saltpetre, and 1 of sal ammoniac; this will keep the seeds cool, and preserve their vegetative power.

Seeds and nuts in their pods may be inclosed in linen or writing-paper, and put into canisters, jars, or bottles; the interstices between the parcels should be filled with whole rice, millet, wheat-bran, or indian-meal well dried. To keep off insects, put in at the top of each canister a little camphor, sulphur, or tobacco, and cover it close.

Seeds well dried may be put into a box, not

made too tight, upon alternate layers of moss,—in such a manner as to admit the seeds to vegetate or shoot their small tendrils into the moss. In the voyage, hang the box from the roof of the cabin. On arrival, put the seeds into a pot of mould, with a little of the moss about them,

In whatever manner seeds have been preserved, it should be a constant precaution to sow them as soon as they have been exposed to the air; otherwise they probably will never vegetate.

Plants. When you are about to undertake a botanical excursion of a few days, provide a tin box 18 inches long by 6 wide; as also a bill-hook, fitted to screw to the end of a cane. If you are desirous to collect cryptogamous* plants, particularly of the mushroom tribe, which are moist and fragile, and dry quickly, being thereby subject to the speedy loss of their colour and shape—have a large-mouthed bottle of spirit to hold them; fruits with a soft pulp are to be kept by the same means.

When you gather a plant, see that it possesses, as far as possible, all its generic and specific characters; that is to say, the flower with all its organs, stamen, pistil, ovary, calix, petals, &c,—the fruit, leaves, branches, stalk and root, in whole or in

* Those which have the stamen and pistils obscure,—as ferns, lichens, seaweeds and mushrooms.

part. If the whole plant be too large for the box, select specimens of parts, but always those above enumerated.

All seasons of the year are favourable for this business; in the spring, however, you will find the greatest number of the phanerogamous* species. The most interesting among the cryptogamous kind, abound in autumn and throughout the winter. A plant should not be gathered before the sun has wholly dried up the dew upon the flower and stalk. Every plant should as soon as plucked, be deposited in the box, with the precaution not to bruise the flower or stalk. Put the roots in along with them, and if you are to be some days upon the excursion, wrap them in a little wet moss; by this precaution, and by keeping the box open as little as possible, you may preserve the flowers for a fortnight. Sea weeds require to be washed in fresh water, and then dried between sheets of paper.

Wood. It is also desirable to collect specimens of useful woods. These specimens ought to be about ten inches long, and if possible, the width of the tree. It would be well to procure a longitudinal and transversal cut of the tree. Gather a branch of the tree for the herbarium, and put a number on the wood corresponding to

* The reverse of the cryptogamous in regard to the organs above mentioned.

the branch in the herbarium ; this is very essential, for botanists are still ignorant to what trees several of the woods belong, which are articles of commerce.

OF COLLECTING MINERALS.

Since we have abandoned systems, to confine ourselves to the observation of facts, and to compare these observations,—since we have renounced the attempts to guess the origin of things, in order to ascertain their actual state,—geology, which formerly belonged to the domain of the imagination, has followed the course of the positive sciences. This regular method has not only extended our knowledge of the construction of the earth, but has produced results useful to the arts.

It is easy for those who visit distant countries, to procure important notices, and send home productions, the examination of which can furnish us with ideas of the nature of the soil in different climes, and consequently the general disposition of the minerals which cover the surface of the globe. On all coasts and at all islands where a vessel harbours, those who go on shore can without much difficulty procure objects, which, not possessing any value in themselves, may become

instructive and interesting from the notes by which they are accompanied.

Collect first, on the borders of rocky torrents, fragments which indicate the nature of the rocks over which they pass. Choose the largest; note their size, and break some of the fragments. Take also some of the smallest, exemplifying the variety of aspect. The further these fragments are brought by the stream, the smaller they become.

Wherever a rock rises, either in the middle of a water or country, travellers must observe if this rock be all of the same substance, whether homogeneous or composite, or if it be formed of different layers. In the first case, detach a portion. In the second, observe the relative position of the strata, their inclination and thickness; take a specimen of each, putting the same mark on all the specimens which come from the same mountain, and a particular number on each of them, to indicate the order of their superposition, or their reciprocal situation. If you can join a sketch to the simple mention of these particulars, indicating the form of the mountain, and the thickness and inclination of the layers, the specimens will be still more valuable. If the rock be an isolated peak, it will be well to examine and draw two faces, to confirm the inclination of the strata.

It will be useful to collect the sand of rivers, especially those which carry metallic spangles with them; the sand must be taken as far from the mouths as possible.

In some countries isolated masses are found, to which the people ascribe an extraordinary origin; take fragments of these; some may be aerolites (meteoric stones),—others may have been transported by the revolutions of the globe.

In gathering the fragments of rocks, mines, volcanic productions, fossil or organized bodies, the most essential thing is to notice their bearing,—that is, the nature of the soil where they are found, and their position relative to the minerals which environ them.

Basaltic layers merit a particular attention, either in themselves, or with respect to the soils which support or cover them; remark if they are divided into irregular masses, in tables, or prisms, and what is their disposition; observe if they contain the remains of organized bodies, and collect specimens of the different states, as well as of the substance upon which the basalt reposes; ascertain particularly if there be no interposition of scorified matter, or of those beds of an earthy aspect, to which the Germans give the name of *wakke*, and which are supposed not to be volcanic.

It is not necessary to take pieces of a large

size ; specimens of two and a half or three inches square, and an inch and a half thick, are sufficient. Take large masses only when they contain a fossil animal.

Minerals are found either in regular and geometrical forms, which bear the name of *crystals*, or in masses more or less irregular. Amongst the crystals there are some so situated, that we can without injury separate them from their support, or the substance which surrounds them. Others compose groups projecting beyond their support, and others appear buried in cavities in the interior. We must procure as frequently as possible, the specimens in these three states. When crystals are inserted within the surrounding substance, detach parts of this substance with them,—at least from three to four inches large every way, so that we may observe the different minerals which accompany the crystals. Detach also portions of the masses composed of needles or fibres, of the granulous or compact, taking care to choose them in a state of freshness, and free from alteration, which is most obvious in those situated near the surface.

In choosing specimens from mines, be careful to leave round the principal metal, either portions of the other metals which are associated with it, or of the stony substances which often accompany it, especially those which are crystallized.

If you find earths which contain the remains of organized beings,—such as the bones of animals, shells, impressions of fish and vegetables,—collect with care specimens of these different bodies, having them enveloped in a portion of the earth or stone in which they were fixed.

When you find any traces of volcanic origin, procure specimens of the different substances thrown up by explosion,—some of which are in a state of stone, like basalt; others similar to glass, like obsidian; others in a state of scoriæ. For those that are in prisms, care should be taken to note their forms, and the extent they occupy in the soil.

A ticket should be fixed to each specimen, indicating the name of the country where it was found, the spot from which it was taken, and as nearly as possible, the nature and general aspect of the soil, and its elevation above the level of the sea.

Wherever warm or mineral waters are found, care should be taken to fill phials with them, which should be well corked and luted.

Generally in selecting minerals, give the preference to such specimens as are attached to the rock in which they are found; other pieces are likely to be damaged by attrition, or by the simple contact of the air. For the same reason you will prefer those portions imbedded a certain

depth, to those at the surface. In packing up, be particularly careful of the broken part, as that determines the character which relates to the classification of the mineral.

OF PACKING AND TRANSPORTING OBJECTS OF NATURAL HISTORY.

A naturalist in a distant country, having a collection of subjects to send home, would be desirous to know a safe method of packing, to preserve them from the accidents of the transportation. We recommend the following.

1. *Birds.* The first thing is to skin and stuff them; this we shall enlarge upon hereafter, in the chapter on *taxidermy*. Suppose the skin taken off and prepared as there directed, stuff the body with tow, cotton, moss, or even straw and hay if a very large subject; indeed you may apply to this purpose any soft substance easily obtained, provided it be not of an animal nature —for wool, hair, and silk will attract destructive insects. Before stuffing, place the wings in a proper position, tying them as we have before directed. All the difficulty in arranging the skin, lies in the precaution not to stretch the neck too much; in such a case, it is difficult to bring the skin within its ordinary dimensions, and the head

will sit badly. Put inside the notes you have taken respecting the subject, as directed on a former occasion. Give him the right proportions as to length and breadth in stuffing. If the bird be large, sew up the skin; but if small, you need only bring the edges together.

If you have some exceedingly large, you may to save room, stow one within another, packing all snugly with tow or other soft matter.

Small birds, as those of the size of a magpie or swallow, should be put in paper cones, the head first,—taking care that the bill be not turned out of the proper direction, so as to disarrange the head; which inconvenience would be difficult to remedy at a future time. Take care not to injure the tail, in closing up the cone.

Prepare a box of light wood, but solid; strew the bottom with any soft matter you have used in stuffing; lay on this, first, the large birds, then the small ones between; cover these with the stuffing matter, and add another layer of smaller birds; in this manner fill the box. Salt-hay is the best material you can employ for packing. If the box is to go a long voyage, it should be caulked and coated with pitch on the outside; this will keep out alike the wet, dust and insects. A case thus prepared may be kept upon a voyage two or three years.

If you have none of the above means of pre-

paration, or lack time for taking off the skin, or wish to keep the bird whole for anatomical purposes, you may put him, if very small, in spirit; if large, in a cask of brine. We have seen some kept a long time in this manner, and recover in the hands of an able operator most of their original colours.

With regard to birds already *mounted*—that is, fully prepared and fixed in the cabinet,—it is seldom that they are required to go on long journeys; when this happens, they should be wrapped up carefully in paper rolled into a conical shape, and placed in boxes as above directed.

2. *Mammiferous Animals.* The small kind may be transported in spirit; but the larger must be skinned as we shall hereafter direct, and packed in tight cases as above. If it happens that you have not the means there directed for preparing the skin, you may substitute a powder of calcined alum and arsenic, or a simple mixture of salt and ashes; or in lack of all these, you may give the skin a complete drying.

3. *Reptiles and Fishes.* Most of these are transported in spirit; we know of no better method than that proposed by M. Dufresne:—Wrap the fish in a cloth, and sew him up; fill a cask two-thirds with any sort of spirit, choosing that which is not too highly coloured,—its strength

should be equal to 14 or 15 degrees of Baumé's areometer: at the bottom of the cask put the largest fish, and decrease in size till you have filled it; the cask should be headed and hooped tight, and done over with pitch.

The largest species must be skinned, and prepared like the mammiferous tribe.

4. *Crustaceous Animals.* Spirit is apt to discolour these subjects, and the large kinds would be expensive from the quantity they require; we may therefore recommend the direction of M. Bosc: — Put them in weak spirit, in which you have dissolved a quantity of soap; let them soak in this liquor as long as you have time to spare — never less than 15 days; then dry them upon a board, taking care to give them a good attitude.

These preparations are easily broken, and should be packed carefully in tow, cotton, &c. It is needless to detail any method.

5. *Insects.* These require even more care than the preceding; such as will admit of it, should be preserved in spirit; the others may be fastened with pins upon sheets of cork, and packed according to the skill and means of the operator. Butterflies may be stuck with gum upon paper. The boxes holding all these, should be furnished with small quantities of camphor.

6. *Shells* should be stuffed with cotton, tow,

&c,—when they may be packed in the same, or in saw-dust, fine sand, or moss.

7. *Zoophytes.* The soft kind must be transported in spirit; the others may be packed in the ordinary way, after being well cleansed and dried.

8. *Plants* must be kept in an herbal; but those of a pulpy nature, as mushrooms, in spirit.

9. *Minerals.* To pack specimens of minerals, first cover them with fine paper; above this paper put that on which the notes are written; then a second fine paper,—which cover with tow, and wrap the whole in brown paper. Then arrange all the specimens in a case, close upon one another, filling all the interstices with cut paper or tow,—so that the whole shall form a mass that nothing can disturb. The case should be covered with pitch, to defend it from air and damp.

When the cases are filled, closed, and pitched, they may be enveloped in an oiled canvas, and placed (if beyond sea) in a part of the vessel where they may remain till their arrival,—sheltered as much as possible from excess of heat, and out of the reach of rats. It is desirable that they should not be opened or unpacked at the wharves, or until they reach their destination.

OF THE INSTRUMENTS NECESSARY TO THE PRACTICAL NATURALIST.

1. *Scalpel.* A knife with a short blade, and the handle flat at the end; it may be single or two-edged.

2. *Pincers*, of various powers.

3. *Forceps for dissection.* Some with the jaws notched and jagged on the inner surface, to seize the smallest fragments of skin, muscle, nerve, &c.

4. *Scissors*, with long handles. The same of the common sort, with sharp points. Surgeons' scissors, with crooked blades.

5. *Flat nippers*, of various sizes; a pair of sharp nippers, sufficiently strong to cut a large iron-wire.

6. *Rasps* and *Files*, of various degrees of fineness.

7. *Awls*, *punches*, and *gimlets*, of several sizes, to pierce holes for wires in the legs, head, &c.

8. A *handsaw*, with a strong, well-tempered blade, and fine teeth; this is indispensable for dividing the bones. Other small saws.

9. A *small hammer* and *nails*, of different lengths.

10. *Brushes.* Paint-brushes, to apply the

preservative matter to the skins. Other soft brushes, to clean the fur and feathers from dust, &c.

11. *Wire*,* of different sizes, for *mounting* your subjects. Pass it through the fire before using it. The wire may be proportioned to the bird, according to the following scale.

No. 1. For birds of the size of the *Wren* and *Tom-tit.*

No. 2. The *Linnet* and *Goldfinch.*

No. 3. *Black-bird, Loriot.*

No. 4. *Pigeon, Partridge.*

No. 5. *Pheasant, Duck.*

No. 6. *Bittern, Heron.*

No. 7. *Turkey, Goose, Peacock.*

No. 8. *Bustard, Crane.*

No. 9. *Pelican, Flamingo, Swan.*

And the stoutest you can procure for the *Cassowary, Ostrich,* &c.

OF THE MATERIALS FOR STUFFING.

As upon the proper choice of these materials must depend the preservation of your subjects, we shall go into some detail here. The best materials are —

* The wire which we buy with the polish on, is not sufficiently pliant, but snaps in bending.

1. *Cotton*, for small birds, and those of any size where you can afford the proper quantity. When it is of a long staple, and your subject be very small, chop it up with scissors.

2. *Flax* and *Hemp*, combed more or less fine, according as you want it. This should be employed for birds of the size of a pigeon and larger; for smaller ones it may be chopped.

3. *Moss*. Before using it, pick it clean, and bake it in an oven to kill the vermin which may infest it; use it for birds as big as a hen or larger.

4. *Salt-grass*. An excellent material, as it seldom contains insects; apply it the same as moss; wash it first in fresh-water, as the salt with which it is imbued would attract humidity.

5. *Common grass*, baked in the oven, may be used to stuff large animals,—such as the dog, wolf, bear, or the pelican, swan, ostrich, &c.

6. *Straw* is seldom used, except for very large animals,—like the deer, horse, bison, or rhinoceros. It is not commonly baked, though this precaution may have its use.

When none of the above are at hand, and you are driven to substitutes, be careful to select them from the vegetable kingdom. Never make use of *wool*, *hair*, or any animal substance; they all attract insects.

A subject need not be restricted to a single

material; different parts may be stuffed with different matter, according to the size of the cavity to be filled.

If your subject be very valuable and you have sufficient time, you may have an additional means of preservation, by soaking the stuffing for twenty-four hours in a strong solution of alum; take care to dry it completely before use.

OF PRESERVATIVES.

The best preservative against the ravages of insects, is that furnished by the naturalist Becœur; his *arsenical soap* is used with success in the Museum of Natural History at Paris, and by all the operators, traders and amateurs in these articles, in the capital. It is made thus:—

Arsenic pulverized,	2 lbs
Salt of Tartar,	12 oz
Camphor,	5 oz
White Soap,	2 lbs
Lime in powder,	4 oz

Shave the soap into small pieces, put it in an earthen-pan over a slow fire, add a little water, and while it dissolves stir it with a wooden spatula; take it off and add the tartar in powder; stir it well till the whole is amalgamated, then add by little and little the lime and arsenic; as it grows

stiff, triturate it till a complete mixture is effected. Grind up the camphor in a mortar with a little spirit of wine, or dissolve it in a sufficient quantity of the same; add this to the mixture when quite cold, but not before, as the least heat would cause it to evaporate; stir it well in, and it is fit for use.*

For preservation, put it in a glazed earthen-vessel, well stopped, and keep it in a damp place to prevent drying. To apply it, take a quantity upon a brush, which dilute in water to the consistence of thin paste, and anoint the hide or whatever substance you wish to preserve.

When great quantities are requisite in the preparation of a very large animal, it has been customary to adulterate it with lime, in the proportion of from one quarter to a half.

Some naturalists, apprehending danger from the constant use of arsenic, have sought a substitute for the above; but their efforts have not met with full success. To make our work as complete as possible, and facilitate new researches, we shall specify a few of their compositions.

M. Boitard, in his cabinet of natural history,

* When any *preservative* is mentioned in the course of the work without any allusion to its composition, it is to be understood that the abovementioned *arsenical soap* is intended.

has what he calls a *soap pomade*, of the following materials:—

White Soap,	1 lb
Potash,	½ lb
Alum in powder,	4 oz
Water,	2 lbs
Rock Oil,	4 oz
Camphor,	4 oz

Shave up the soap, and put it in an earthen vessel over a fire; add the water and then the potash; when the whole comes to a paste, add the alum and rock-oil; after it is cold, mix in the camphor ground up with spirit. Use this with the brush as before.

M. Mouton de Fontenille recommends a *tanning liquor*, of this composition:—

Quinquina (Peruvian Bark),	1 oz
Bark of Pomegranate,	1 oz
Oak Bark,	1 oz
Gentian Root	1 oz
Wormwood,	1 oz
Tobacco,	1 oz
Alum,	1 oz
Water,	2 lbs

Boil the whole together except the alum, which add after taking it from the fire. Keep it well stopped. With this you should wet the skin on the inside.

Another author proposes an *antiseptic powder*, of the following ingredients:—

Arsenic,	1 lb
Burnt Alum,	1½ lbs
Purified Sea Salt,	½ lb

For our part, we do not recommend the use of arsenic in powder; it may get into the lungs, and cause serious mischief.

Others use no method but to season the hide with the following composition:—

Burnt Alum,	3 oz
Flour of Sulphur,	1 oz
Black Pepper,	½ oz
Snuff,	½ oz
Savin in powder,	½ oz
Camphor,	3 drs

Others again make use of an ointment of tallow and corrosive-sublimate.

PRESERVATIVES IN LIQUOR.

Liquors are employed for *steeping*, for *lotions*, *frictions*, and *internal applications*, and finally, for *perpetual preservatives*.

Of Steeping. The hides of many animals, particularly of the mammiferous tribe, are too thick to be sufficiently penetrated by the arsen-

ical soap; steeping these becomes an indispensable operation. The following is the composition in use by the Parisian naturalists:—

Water,		4 pints
Alum,		1 lb
Salt,	½ lb	—dissolve by boiling.

Soak the hides in this, when cold. Those no larger than that of a hare, will steep sufficiently in twenty-four hours. A week or fortnight would not be too long for a buffalo or zebra Both green and dried hides should be steeped,—although those of small creatures, which you have kept a long time in alcohol, may be exempted.

When a hide has been imperfectly prepared and begins to corrupt, you may know this not only by the smell, but by the hair's coming off at the slightest touch. The curriers have the following remedy:—Soak it forty-eight hours in the liquor just described; take it out and heat the liquor; put the hide in again, taking care that the liquor be not too hot; when the hide is well heated, plunge it as suddenly as possible in very cold water; this sudden transition will cause a general crisping of the pores,—they contract spontaneously, and the hair becomes firmly fixed.

A skin previously steeped, will require but half as much as ordinary of the preservative soap.

The following is a *tanning liquor* of M. Boitard.

Tan, or oak-bark,	1 lb
Alum,	4 oz
Water,	20 lbs

Let it soak for two days, stirring it from time to time; then strain it. The skin should be stretched, and the liquor poured on so as to keep it covered for at least two inches. Four or five days will answer for the maceration of small quadrupeds; the larger require ten or fifteen. This liquor is better than the one in common use, if more alum were added; the tan, by its astringent power, keeps the hair firm.

Liquors for exterior lavation. When you are apprehensive that the insects will attack an animal already *mounted*, you may preserve him by applying some one of the following compositions to his feathers, hair, or skin. Subjects exposed to the open air, stand in especial need of this defence. Many amateurs lose their whole collections, by neglecting to employ it.

1. The *Essence of Wild Thyme* has lately been used with much advantage. Raise the feathers or hair here and there with a long needle, and with a hair-pencil put a drop or two on the skin at the roots of the same,—which smooth down

again; their extremities not being touched by the liquid, will receive no discoloration.

2. *Sir J. E. Smith's Liquid* is made of the following materials:—

Corrosive Sublimate,	2 drs
Camphor,	2 do
Alcohol,	1 pint

Upon large animals, apply it with a sponge in every part of the exterior, till it be saturated down to the skin. With small animals, use a brush in the same manner. In every case, do not neglect to dry them thoroughly.

The *Bitter Spirit*, recommended by others, is thus composed:—

White Soap,	1 oz
Camphor,	2 oz
Colocynth,	2 oz
Alcohol,	2 lbs

Infuse the whole cold for some days in a vessel hermetically closed, shaking it from time to time; then filter it through brown paper; keep it tightly stopped. Use it like the preceding.

3. *Varnishes* are used only for the skins of reptiles and fishes, to which they restore a portion of their brilliancy. They should be colourless, and perfectly transparent. Dissolve fresh and clear turpentine in alcohol, and apply it with a camel's-hair pencil; dry it in the air, taking care to exclude the dust.

Liquids for internal application. Most of these are used for the preservation of eggs; they have besides been injudiciously employed in the case of very small animals.

To decompose the flesh of a fœtus within an egg, you may employ a strong solution of fixed alkali or tartar; another material is ether.

In drying a small animal, take out the viscera of the lower part of the body, and plug up the shot-holes with cotton; draw out the brains at one of the eyes with an ear-picker, pour in ether at the same place, and stuff the skull, eyes and bill with cotton; then inject below a quantity of ether with a syringe. The next day renew this operation at the mouth, stopping up all outlets; repeat this till the flesh be completely dried. But after all, this will prove an unprofitable method; as besides the great cost, the subject will never make a good appearance.

Perpetual preservatives for such animals as cannot be dried. These liquids should possess the following qualities. They must be, 1st, *free from colour*, that the subject may not be stained; 2d, *void of causticity*, that the colour of the animal be not changed thereby; 3d, *transparent*, to exhibit the animal perfectly; 4th, *not liable to freeze.*

The following liquids are those the most in use for this purpose.

1. Alcohol, or spirit of wine of the strength of 14 or 18 degrees of Baumé's areometer, appears to occupy the first rank. Spirits distilled from grain, potatoes, or molasses, are all equally useful.

2. M. Nicolas recommends the following composition: —

Pure Water,	2 pints
Alcohol,	1 pint
Sulphate of Alumine,	6 oz

3. Graves, an English naturalist, proposes a liquor nearly similar: —

Alum,	8 oz
Water,	1 pint
Alcohol,	$\frac{1}{3}$ pint

Heat the water, and when boiling, add the alum in powder; after cooling, filter it through coarse paper, and add the alcohol.

The same author recommends another mixture, to be made cold; thus: —

Water,	1 pint
Alcohol,	1 pint
Alum,	12 oz

4. The Abbé Manesse, after several trials, recommends the following as the result of his experience: —

Alum,	1 lb
Nitre,	1 lb
Sea Salt,	1 lb
Water,	4 pints
Alcohol,	1 pint

The water should be distilled, that it may contain no foreign matter; the alum as clear as possible, and the salt purified. It may be mixed cold, although it would be better to boil it,—taking care not to add the spirit till the rest be cold.

All the above liquids, with the exception of the alcohol, are more or less subject to freeze.

PART II.

TAXIDERMY.*

We give this name to the art of stuffing the skins of animals; and by extending the term, to that of mounting and preserving them, and restoring them to the appearance of life.

OF SKINNING BIRDS.

We shall begin with birds; which, although more easy to stuff than the mammiferous tribe, require more study and precaution, if you wish to preserve the splendour of their colours and the graces of their attitude.

We have already given directions how to treat a bird when first taken; suppose you have him now in your hand.

If the feathers be bloody, you may restore the freshness and beauty of their colour in this way:— Dissolve a little soap in water, and wash them well; wash again with clear water, and sprinkle on your powdered plaster; this last repeated

* From τασσω, *to arrange;* and δερμος, *skin.*

several times, will dry the feathers completely,—it imbibes the water and forms a crust, which you must remove, and add more plaster.

Birdlime is taken out as before directed; but if the fat of the bird has exuded at the wound and stained the feathers, the operation is more difficult; the best method is this:—Apply a slight coat of spirit of turpentine with a camel's-hair pencil; wash it out with a solution of potash, then with alcohol, then with pure water; if the stain be tenacious, use the method recommended for the butter applied to the birdlime.

The first thing in skinning, is to empty the stomach, if it be distended; as its contents may escape by the mouth, and stain the plumage. Hold the bird up by the legs, and with the other hand squeeze the contents down to the mouth, where you may take them out with a little pains; dry up any humid matter at the mouth and elsewhere with plaster, and stop up with cotton; be careful not to deform any of these parts in the operation,—for, as already remarked, naturalists have established characteristic divisions upon the shape of the nostrils and corners of the mouth.

If the bill is very short and pointed, so that you apprehend a difficulty in pulling it out from within the skin, when the latter is turned upon the head in skinning, as hereafter to be ex-

plained,—pass a wire through the nostrils, and bring the two ends up into a knot; with this you may handle the beak, and hinder it from tearing the skin during the operation.

Lay the bird upon his back,—the head to your left hand, the tail to your right; with the finger and thumb of the left hand draw aside the feathers down to the skin, in a line from the throat across the breast to the belly; cut through the skin along this line,—the least pressure with the two fingers of the left hand will draw the edges of the incision apart; seize one of the edges with your nippers, and with the other hand, or the flat handle of your scalpel, detach the skin from the muscles as you raise it with the nippers. When you have skinned as far as you can go under the wing, sprinkle on plaster to keep the skin from the flesh, and take up the blood and fat; use the plaster for every such necessity; turn the bird, and operate the same on the other side, till he is skinned right and left up to the roots of the wings.

Arrived at this spot, cut off the wings from the body with scissors, and be careful in this process not to break the skin,—which accident is very common in the case of small birds. Detach the skin about the base of the neck, and cut off the neck as near as possible to the body.

You then come to the thighs, which cut off

like the wings, at the joint of the *femur* and *tibia;*—this demands some explanation,—few people give the right names to the different parts of this limb of a bird; the scaly part immediately above the claws, commonly called the leg, is named the *tarsus;* above this is the *heel*, then the *tibia*, then the *femur*.

The skin now adheres to the body only on the back and lower parts; turn the bird back upwards, and draw the skin gently down, separating the muscles with your finger nails; in approaching the tail, stop a little short of the insertion of the feathers,—cut it off with the tail-feathers attached to the skin, and the body is then disengaged.

It remains to separate the skin from the other parts,—to begin with the legs; strip the *tibia* as far as the *heel*, scrape the bone with the blade of your scalpel, and carefully remove the smallest particle of muscle or tendon; then give both skin and bone a good coat of the *preservative;* stuff the *tibia* with tow or cotton, to replace the flesh, and bring it to its natural shape.

Remove in the same manner all remnants of fat and muscle about the tail; apply a coat of the preservative, and stuff the part into shape. Treat in a similar manner the wings, but these last will require no stuffing.

Your next care is to strip the head; when you

have drawn the skin down to the cavity of the ear, have a care that it does not break in this spot; detach this part from the head by raising it under the little bag formed by the membrane of the ear, plucking the extremity of this last out of the cavity of bone to which it is attached. Keep pulling down the skin till you reach the eyes, and cut the membrane which unites the eyelids to the edges of the sockets; mind that you do not injure the eyelids in this operation, nor crush the ball of the eye—which would totally spoil the plumage with its liquid matter.

When the skin is drawn quite down to the root of the bill, draw the eyes from their sockets, and clean the latter; remove the muscles and membranes of the skull, and all the flesh about the bill, and lay every bone bare; cut off the lower part of the head, that you may more easily extract the brain; if the bird be large, it is sufficient for this purpose to enlarge the occipital cavity; the whole inside of the skull may then be cleaned.—Your work of stripping is thus completely finished.

Now apply your preservative to the interior of the skin, within the skull, the sockets of the eyes, the bill,—in fact in every place where you deem it necessary; but avoid the eyelids, as by passing through the cavities of the eyes, it would stain the feathers. Stuff the skull, the orbits of

the eyes, and the bill; this done, immediately turn the skin of the neck—which has hitherto been inside out—back again.

All these operations must be done with despatch; the skin of the head is very slender, and dries quick; once dry, it will be very difficult to turn. Until you have acquired dexterity in the practice, you would do well to keep the skin moist, by sprinkling it from time to time with the steeping liquids we have prescribed, or even with water.

The skin of the neck is very pliant; take care not to stretch it much in skinning, turning, or stuffing; when it is extended beyond its proper length, it becomes flabby, and the feathers so disarranged that it is impossible to smooth them.

As soon as the whole skin is restored to its proper shape, set the plumage in order,—for if you postpone this till the skin be dry, you will find it impossible. For this purpose, hold it by the bill, shake it gently, blow in the direction of the feathers; pinch down with the nippers any contrary feathers here and there; with the same implement open the eyelids, put them into shape by arranging the stuffing in the sockets. Introduce the preservative at the bill; and if wanted, stuff in cotton to replace any deficient member, as the tongue, larynx, &c.

You come now to the stuffing of the body. Beginning with the neck, lay the bird upon the back as directed at the first of the operation; pass into the neck the stuffing matter with a pair of slender pincers; the skull, you will recollect, remains attached to the skin, but denuded of all its flesh; introduce the stuffing carefully between the skin and the skull, to bring the head to its proper shape; this done, fill up the neck, by adding wads of stuffing larger and larger as the neck increases in diameter.

We now come to a process the more indispensable, inasmuch as it determines the possibility of giving the wings a good position in mounting. The bone which joins the wing to the body, is named the *humerus;* the two next, which articulate with this and run close together the whole of their length, are the *radius* and the *cubitus;* take each wing by the humerus, and draw them together over the back; then, with a needle or awl, pass a wire between the radius and cubitus of each, and twist the ends of the wire together,—so as to bring the wings a line or two apart in the smallest birds, three lines in those of the size of a lark, and progressively for the rest; it is necessary to be explicit here, for the point is essential;—the above distances are to be reckoned between the upper edges of the wings when elevated, and from the joint made

by the articulation of the humerus with the radius and cubitus of one wing, to the same joint of the other wing.

This done, apply a new coat of preservative to all the bones of the wings which you can get at; then wedge in between the joints of the humerus just mentioned, a wad for the purpose of keeping them apart. Apply the preservative to every part of the skin, but take care to let none of it touch the feathers; the stain would be difficult to efface.

The remainder of the stuffing process will not require any detail; no cavity or fold of the skin should remain empty; bring it out to its natural size; it should not be stuffed harder than to offer about the same degree of resistance as a sponge, when pressed. — Your bird is now stuffed; if he is to be sent away before mounting, close the edges of the skin, and pin them together if necessary, — which however is not generally the case; he should be kept free from dampness.

It is difficult to preserve an ostrich, by making use of the arsenical soap only. The feathers being very long and thick, you must soak them with spirit of turpentine at their roots, and place little bags of camphor at intervals.

OF MOUNTING BIRDS.

To *mount* an animal, as we shall use the word, is to give him the attitude, grace, and air of animation, which he possessed while living. A bird is mounted either *fresh*, or *prepared;* in the first case, the operation is performed immediately upon stuffing and skinning; in the second instance, we suppose that the skin has become dry after this process,—in which case it must be softened, in order to receive a proper shape. Subjects generally receive the first preparation at a distance from the spot where they are finally arranged for the cabinet. We shall suppose this last instance.

Take out the stuffing, and return a quantity of similar matter previously dipped in water, taking care not to wet the feathers; having put the skin to soak in this manner, proceed to the legs, and wind around them quantities of wet tow; in large birds the legs take some days to soften, for which reason you should begin with them first. Put the bird in a vessel or basket, and stop out the dry air by covering him with tow or cotton; place it in a cellar or damp place, till the skin has grown supple; for small birds, twenty-four hours will suffice; large ones require three or four days. When you have examined the skin throughout,

and find it sufficiently soft, take out the wet stuffing, and apply a coat of the preservative; then stuff it for the last time.

Now get ready your wires; we have already specified their proportionate sizes. Cut one wire for the chief supporter, that is, one fourth longer than the length from the beak to the beginning of the tail,—we will call this the *main* wire; straighten it, and sharpen the two ends; cut two others of equal size, and long enough for the legs; sharpen one end of each.

Bore a hole through the claw upwards, and introduce one of the wires for the legs; pass it behind the tarsus to the heel, straighten the joint, and continue the wire through the tibia to the body;—you thus have all the joints of the legs straight, and can bend them into any position you choose; the wires you will recollect are previously to be passed through the fire.

Take the main wire, and at one-third from the end twist a portion of it into a spiral ring; pass the shorter end through the centre of the neck to the head, bore through the cranium with the point of the wire till it comes through in front; the proportions of the wire must be so managed, that in this position the spiral ring is just below the thighs, and the lower end of the wire going through the rump passes out among the tail-feathers to their extremity; the wire thus extends

through the head, neck, body and tail, from end to end. Twist the upper ends of the leg-wires with your pincers around the spiral ring, and bend all the wires so as to bring the bird into proper shape.

The central wire should be passed into the neck *after* stuffing; this is not only the easiest method, but it preserves the neck in its cylindrical form. Even the long neck of a swan should be no exception.

If you desire to have the tail spread, twist the lower extremity of the wire into a ring, or fork it by adding another piece; these support the feathers in an extended position. All the above despatched, finish the stuffing and sew up; this last must be done with care, that no traces of the seam remain; in taking the stitches, always pierce the skin on the *inside;* if any part be pressed out of shape during the process, you may re-adjust the stuffing afterwards, by thrusting a large needle or fine awl under the skin.

In setting the legs in position, observe that the joints of the heel should jut toward the under part of the tail, and that these joints should be nearer together than the lower extremities of the legs. This is the time for knowing whether the habit of the bird is to *perch*, or not,—that is, whether he alights upon a branch or a flat surface. The study of Natural History alone can

give any precise knowledge upon this point; still we can furnish the reader with such general information, as will enable him to avoid any gross errors.

Birds of prey in general perch; vultures perch or not, at pleasure. In a picture or cabinet, you may put eagles, vultures, and most nocturnal birds of prey upon a heap of rocks.

The tribe of *passeres*, constituting the ancient class of pies and ravens in the system of Linnæus, all perch. Some of them, as the magpie, crow, &c, may perch or not. Woodpeckers may be stuck against any perpendicular body,—holding on with the claws, and resting upon the tail.

The other classes of *passeres* are of the perching habit, except some kinds of larks, and the house-pigeon. Starlings and blackbirds, in certain circumstances, do not perch.

Geese, ducks, and generally all web-footed birds, save the cormorant, do not perch.

Birds which frequent the sea-shore, and generally all that have the tarsus long, and a bare leg, never perch.

Gallinaceous fowl,* for the most part, do not

* Comprising the barn-door fowl, turkey, peacock, pheasant, partridge, &c.

perch; although a few offer occasional exceptions, as the pheasant, peacock, and guinea-hen.

In placing the bird in position, let him not look straight forward, if you wish to give him an animated or graceful air; turn his head somewhat to the right or left; sometimes you may raise the beak a little. The operator, however, must consult his own taste. See farther on, what we shall say under the article of *grouping*.

If the wings are large, and hang out of shape, they may be furnished with supporters of wire.

But before placing in the cabinet, your subject is to be dried; for this purpose, wrap him carefully in fine cloth or muslin,—this will keep the feathers from being disordered. After drying, furnish him with artificial eyes, of the same colour as the living. For birds no larger than a sparrow, a mere black dot is sufficient; for the middle size, solid, coloured eyes may be used; but the largest, as ostriches, &c, must have them of blown-glass. To fix the eye, you must first soften the eyelid, take out a little of the stuffing at that place, and return it wet,—in an hour or so take it out again, and enlarge the opening; stick the eye in with gum-water; arrange the pupils with a needle, that the eyes may not squint—unless you wish to represent the bird in a passion; we have remarked, that these ani-

mals, when enraged, bring the pupils of the eyes towards one another; in a state of repose, they are in the middle of the orbit; when agitated by love, they are turned away toward the outer angle of the eye.

Now with a sharp pair of pincers cut off the top of the wire even with the crest, smooth down the feathers, and your subject is fit for the cabinet.

Remedies for Occasional Difficulties.

1. Sometimes the head of a bird is furnished with a crest or comb, requiring careful handling; or is too large to admit the skin of the neck to be turned over it:—Make an incision from the crest to the first vertebræ of the neck; and by means of this, prepare the head as before directed.

2. If the bird has a fleshy comb, you may follow two methods; in the first, stretch it out with pins and wires till dry, after which you may paint and varnish it;—in this process, however, the membranes contract, and destroy that appearance of animation, which constitutes the beauty of the subject. In the second method, remove the

whole mass, and substitute an artificial one of mastic, coloured according to life.*

3. Web-footed fowl should have their claws stretched out with pins in drying; all the scaly parts should receive a coat of spirit of turpentine,—as a preservation, and to maintain their brilliancy.

4. In a large bird, if the wings hang down by their own weight, they may be kept in position by wires passed through them,—as in the case of the legs.

5. If a bird worth preserving has lost some of his feathers, select from some other bird a quantity of feathers which resemble the lost ones; with these you may replace the deficiency, thus:—cut off the quill of each feather, dip the cut

* Good mastic may be manufactured thus:—Take two parts of whiting, and one part of white-lead; grind them in a marble or metal mortar with a little nut-oil, made desiccative as for painting; or if the oil be unprepared, it must be very old; then let it ferment twenty-four hours at least; after which, add more oil, and grind again till it be soft and ductile, so as not to stick to the fingers. This is good white mastic.

To colour it, add during the trituration,—lampblack for any degree of dark colour, red-lead for flesh, vermilion for the red parts of certain animals, indigo and red mixed for the violet membranes of the turkey, ochre for yellow, &c. Keep the mastic in a leather-bag or vessel; the older it is, the better—provided it does not dry. When used, it should be softened anew with oil.

end in gum-water, and stick it in its proper place upon the skin; when you have completed a row thus, begin another row above them, covering two-thirds of each feather in the first row; proceed thus, till the whole vacant space is covered.

6. If you have the skin of a bird in pieces, or if you have two or more of the same kind all partially deficient, you may construct a complete subject by putting together different parts of them all; make a stuffed body of the shape of the bird, and glue on the several pieces with gum-water; they should be all of the same sex and age.

7. The bills and legs are apt sometimes to lose their colour,—this may be restored by painting; the paint should be very fine, and prepared with oil of pinks; add a coat of varnish. If the legs have lost their scales, you may remedy this to a certain degree by little bits of parchment, stuck on with gum-water; varnish these likewise.

PREPARATION IN DEMI-RELIEF.

This gives a profile view of half the bird:—Cut one-half the skin, taking the whole tail; with a fine saw cut off half the head, saving the

bill; you may attach this to a sheet of thick pasteboard or wood, stuffing it properly; let the head be turned a little toward the spectator, and the effect of the attitude will be much increased. The above is a good method, when you have a valuable subject partly injured.

PREPARATION IN ST ESPRIT.*

By this method, subjects may be compendiously packed. Skin the bird as already directed, but leave no bony part; cut off the skull as near as you can to the roots of the bill, taking care not to injure these last; in a small bird you may leave the tarsus, but not in large ones; scrape off all the fat from the skin, and give it a coat of preservative; when three-quarters dry, lay it upon brown unsized paper, and spread out the wings, tail, legs, &c; stuff a little cotton in the head, to bring it on a level with the beak; add artificial eyes, cover the whole with paper, and press it lightly between boards; shift the papers every day if they grow damp; when dry you

* This is explained by the French authors, as an '*attitude que les peintres donnent à la colombe par laquelle ils representent le St Esprit, c'est-à-dire, qu'on etend les ailes,*' &c.

may fasten it upon pasteboard. Preparations of this sort you may keep in portfolios. Preserve them from insects by Smith's liquid.

PICTURES.

Draw with a lead-pencil the profile of a bird upon fine pasteboard; cover the figure with gum, and stick upon this the feathers plucked from the bird; add the bill and legs the same way, or by painting. The whole may be framed like a common picture. These preparations, however, are more valuable as ornaments than as objects of science.

NESTS AND EGGS.

These are generally neglected, but they are not without interest in the study of natural history. A nest, before being placed in the cabinet, should be baked,—to destroy the insects. When it consists in whole or in part of animal matter, as feathers, wool, and the like, soak it with Smith's liquid.

Eggs are prepared thus:—Pierce one end, break the yolk with a needle, shake the egg till

the yolk and white are mixed; then pierce the other end, and blow out the contents; rinse the shell clean with water by a syringe.

If there be a chick within, stick it in as many places as you can with the needle, and inject a strong solution of fixed alkali, or salt of tartar; shake it, and leave it till the next day; by this time a portion of the contents will be decomposed, and you may blow it out. Repeat this operation till you have emptied the shell.

OF SKINNING AND MOUNTING MAMMIFEROUS ANIMALS.

The first thing which demands attention, is to note whether the animal has been dead sufficiently long for the blood to coagulate; for if it be still warm, it will escape at every stroke of the knife, and stain the fur.

We shall particularize only such details as distinguish this process from that previously described. Take off the head and legs with the skin as before; skin the legs down to the feet, and remove from the bones all the flesh, muscles, nerves, and tendons,—but spare the ligaments of the joints, that these last may not separate. If the hoof be large and fleshy, remove the flesh

and fat. To skin the tail is the most difficult:—lay bare the first two or three joints, and tie them strongly with a cord; fasten the cord to a wall; take a cleft stick, and pinch with the split the bare joints of the tail; then, with a hand on each end of the stick, draw towards the extremity, and the bones of the tail will come out of the sheath.

In skinning the head,—when you reach the ear, take out along with the skin the membrane attached to the cavity of the ear, by detaching it as carefully as possible close to the bone to which it adheres. Arrived at the eyes, be careful not to injure the eyelids; pull upon the hide a little, and when the membranes which unite the eyelids to the orbits are well stretched, cut them off; skin away down to the nose.

The hide is now attached to the skull only by the nose, and the tip of the lower-jaw; enlarge the occipital opening, that you may take out the brains; remove all the flesh and muscles from the skull, but spare the ligatures of the jaws.

When a large animal is killed far from any habitation, and there is no opportunity of steeping the skin, the following method may be pursued. When the hide is cold, sprinkle it on the inside with cinders,—after having extended it on some boughs for the air to circulate below. Put

spirit of turpentine on the ears, lips, and feet, several times. In two or three days, when the hide is a little dry, turn it the hair within ; and if sea-salt be at hand, wet the hair with brine ; repeat this on each side of the skin two or three times, at intervals of twenty-four hours.

When it is dry, the hair must be rolled inwards, beginning with the head ; and care must be taken to put a layer of dried grass or moss, to hinder the friction from spoiling the hair during the conveyance. If the passage be long, it will be necessary to spread the skin occasionally in the sun, and put spirit of turpentine or petrolium on such places as the insects attack ; for want of these liquids, you may use a decoction of very bitter and aromatic herbs,—or you may apply internally and externally, pounded tobacco, pepper, and alspice.

We come now to the preservation of the skin ; steep it in the liquid as directed in page 89; when taken out, squeeze it to force out the most of the liquid, but take care not to stretch any part ; give the whole hide and skull a good coat of preservative ; furnish the legs with wires, as before directed of birds ; stuff every part, and your subject is ready to be finally mounted.

After what we have said of preparing birds, the reader will understand in a general way how the quadruped should be provided with internal

supporters ; but the operator must be left to his own taste and ingenuity; one thing must be remarked,—the skin of the neck is always longer than the neck itself, an arrangement designed by nature to allow the animal to raise and lower the head without too much stretching the skin ; the operator will bear this peculiarity in mind, and not make the neck too long when stuffed.

If any part be squeezed out of shape in sewing up, raise up the stuffing by piercing through the hide. Take care that the eyelids do not get out of shape ; stuff the orbits with cotton while they are drying; stuff also the nostrils for the same purpose, and set the ears in position ; put in the artificial eyes, or wait till after drying for this purpose; they are to be glued in with gum; dry him in an airy place, but in the shade.

Nothing now remains but to give your animal an appropriate attitude,—and here the operator has an occasion for displaying his taste, and the results of his observation of living nature ; the subject should exhibit that sort of grace peculiar to his species, and the air of animation which presents a counterfeit of life.

Remedies for Occasional Difficulties.

1. Some animals have upon the abdomen a singular sort of membrane, which is the charac-

teristic of the species; such are the opossum and kanguroo; the pouches of these animals must not be cut,—they should therefore be opened on the back; the membranes should be stretched out with pasteboard or stuffing till dry.

2. Horns will sometimes produce embarrassment; when a horn is covered with the skin and hair, as that of the giraffe, saw it off from the skull, and let it go with the hide,—you may replace it when you come to the stuffing; but if the horn be in substance like that of an ox, cut the hide around the roots of the horns, and leave the latter on the skull.

3. Some ferocious animals make a striking appearance with the mouth open; for these you may manufacture the tongue, and other interior parts, from mastic; when the mastic is dry, give it a coat of transparent spirit of wine varnish, and you will have a perfect resemblance of nature.

4. Animals with a close, short, smooth fur, present an almost insurmountable difficulty to those who are ignorant of the method of producing those variations in the surface of the skin, which are caused by the muscles and tendons,—particularly those of the legs. In nearly all quadrupeds, the *tendo Achillis** is very prominent, and almost detached from the limb,—thus giving

* The ligament of the heel, which moves the foot.

grace and agility to the movements of the animal; if the leg be stuffed without attending to this fact, its shape will be spoiled; the proper method is this:—we directed to spare the ligatures of the joints, in removing the flesh, &c, from the leg bones; the *tendo Achillis* passes up the back of the leg; to make it prominent under the skin, wind packthread around its whole length, till you have got it of the proper size; if this operation be not sufficient, draw the skin in on each side of the leg, by sewing it through and through between the bone and the tendon. Lest the purpose and operation of the above process should be misunderstood, the reader is desired to look at the leg of a living quadruped, and notice that it is not completely round,—but flattened or grooved on the sides, and approaching to something like an edge on the back; this should be imitated as nearly as possible, by the means above specified.

Other inequalities in the surface of the skin, are to be effected in the same manner. Sew the skin through and through, and draw the thread till you have made a proper cavity in the surface.

5. Such animals as bats, flying-squirrels, and the like, should be well steeped; they may be dried by stretching out upon pasteboard; when

dry, give the membranes a good coat of spirit of turpentine.*

ELEPHANTS.

The following is the description of the manner in which an elephant, now in the Museum of Natural History at Paris was prepared.

'The corpse of the elephant having been extended upon the ground, facilitated our taking its dimensions; the thickness was taken by a sort of rule, which M. Lassaigne, cabinet-maker of the Museum, invented at the time; this instrument resembled the rule used by shoemakers, on a large scale. The curves of the back, belly, &c, were taken by bars of lead three-quarters of an inch thick; this metal, not having any elasticity, accommodated itself to the curves we wished to measure. M. Desmoulins drew the animal on one side of the wall, according to all these measurements, in the workshop where the model was to be constructed in its natural size. This done, we proceeded to the skinning of the

* The reader need not be discouraged by the length and minuteness of any of our directions; a little practice will enable him to prepare and mount any quadruped of ordinary size in four or five hours, and a bird in one.

elephant, which we were only able to place upon its back by means of four-corded pulleys fastened to the platform. In this position, we made an incision in the form of a double-cross; the middle line went from the mouth to the anus; the two others were directed from each left-foot to the opposite right-foot; the tail and trunk were opened underneath, longitudinally. We scooped out the soles of the feet within an inch of their edge, that the nails might remain in the skin; to effect which, we were obliged to employ the chisel and the mallet. This operation was very difficult.

'After four days' labour of several persons, we separated the skin from the body; it then weighed 576 pounds. We extended it on the ground, to take away the cutaneous muscles which adhered to its interior, particularly to the head. In this state, the skin was placed in a large tub; we spread a considerable quantity of pounded alum in all the folds; we then boiled alum-water perfectly saturated, and poured it upon the skin till it was covered six inches deep.

'To render the dimensions of the model which was to receive the skin more exact, we modelled one-half of the skinned head in plaster,—as well as one of the hind and fore legs.

'Lassaigne then constructed a factitious body, of linden-wood; this was done in such a manner, that all the parts could be separated. He opened

a pannel, and introduced himself inside by means of this opening,—either to diminish the thickness of the wood, or for any other purpose. The head, the trunk,—all was hollow;—so that the body, alarming at first from its supposed weight, might be easily transported from one place to another.

'The sides of this model are hardly more than an inch thick. The folds or wrinkles of the skin were adjusted after a beautiful little cast belonging to M. Cuvier.

'After taking the alum-water from the tub where the skin was placed, we heated it and poured it boiling on the skin; we left it an hour and a half in this state, after which we drew the skin out, to place it quite warm upon the shape. This was not an easy thing, but it was rendered still more difficult by our finding the false body a little too large; the skin would not entirely cover it, and there was but one thing which could be done; we could not diminish the wood, without destroying the proportions. We then took down the skin, placed it on tressles, and diminished the thickness of it by means of large knives, cutting it away in thick and long shreds from the whole of the inside; this work occupied five persons for four days. We weighed these shreds, and they amounted to 194 pounds. During this operation the skin had dried, and conse-

quently lost its suppleness. We put it back into a tub, and covered it with soft, cold water; the next day we placed it afresh on the shape, and fixed it with wire, nails, and large brads; those which fixed the edge of the skin, were driven in deeply; the others only half-way, to accommodate the skin to all the sinuosities of the model. We drew out a great many of them, when the skin was sufficiently dry.

'This paring of the skin answered our purpose in two essential points; first, by facilitating the means of enveloping the model entirely,—the form of which had not been altered; and secondly, by ensuring its speedy desiccation. This last had not been the least alarming, for we feared that the humidity secreted in the skin might concentrate in such a manner (notwithstanding we had taken the precaution to give the wooden model a coat of paint), as to occasion mouldiness in the parts exposed to the air. The alum with which it was saturated soon crystallized on the interior, and at first gave it a very ugly gray colour; but we entirely got rid of it, by rubbing the surface of the skin, first with spirit of turpentine, and then with olive-oil. Thus the appearance of life was given to one of the largest animals on earth; and which till then had only figured in our museums as a hideous mass, devoid of all resemblance to nature.'

The *camelopard*, the *couaga*, the *condoma*, (a species of antelope,) which are in the gallery of the Paris Museum, have been mounted in this manner, which serves for most large animals.

HEDGEHOGS.

These are mounted in the usual way; but as they have the habit of forming themselves into a ball, by drawing in all their extremities, it is necessary to know how to give them that attitude. When the hedgehog is skinned, lay on the preservative, and stuff it a little less than usual to insure its bending; sew it up without putting in any wires, and it will be sufficient to draw the head and fore-feet together under the middle of the belly. Then, to preserve this form, place him on his back in the midst of a large cloth, the four corners of which tie strongly together, and hang it in the air to dry

FISHES.

Where there are scales, the skin should not be turned when taken off, lest the scales become detached. Cut off the head, at the first joint of the back-bone; the head need not be skinned,

but emptied by the occipital opening and gills. Take out the eyes; keep the fins in position between pieces of cork or pasteboard; give the skin, day by day, a coat of spirit of turpentine,—which will hasten its drying, and preserve the colours; but first apply the preservative. After stuffing, furnishing with wires, eyes, &c, and when the whole is quite dry, varnish it. The drying must be done in the dark, as the light will take out the colours.

The most effectual way of preserving fishes, with a view to the study of natural history, is by liquor. Choose always the small ones, where the size would otherwise be incommodious. A small fish is as perfect a specimen, generally speaking, as one of the largest size. In a great number of specimens, a fish will be complete, and possess every organ fully developed, before he attains to the fiftieth part of his growth.

The only precaution necessary before putting a fish in liquid, is to wash the skin in fresh water, and rub it with a soft brush to remove the mucosity.

SEALS.

These amphibious animals have a very thick skin, which must be diminished by taking away as much as possible of the fat; the preservative should be plentifully applied. They are always placed on the belly; put some spirit of turpentine on the naked parts of the fins.

The *Porpoise* and *Dolphin* have sometimes two or three inches of fat under the skin, which it is difficult to take away entirely at the first trial. Renew the operation several times, and scrape away as much as possible with the knife.

To soak up the oil, which flows continually, cover the parts with plaster or bran.

The porpoise will require no iron-work in the mounting; a stick, the length of the body, and entering a little way into the skull, will be sufficient. Stuff him very close, that the skin may be well stretched. Leave the mouth open to show the teeth; which in this genus are very beautiful, and arranged with admirable symmetry.

If the fat penetrate and spot the skin, at any time afterwards,—take ground pumice-stone, mixed with olive-oil, and rub it on with a brush; repeat this, with the addition of emery; when

the skin begins to shine, rub and polish it dry with a woollen cloth.

TORTOISES.

As soon as a tortoise is dead, take the body out of the shell; for if you wait till it be cold, you will find it much more difficult. The upper and under shell are sometimes united by a ligament, sometimes the shell is entire; in the latter case, you must saw the two portions apart; take off the lower shell, and remove the viscera of the breast and abdomen; leave the head and the paws, but no bones in the latter; in emptying the skull, do not widen the occipital opening,—because the skin lying close upon the bone will show every inequality in it, and the back of the head would be deformed were any part of the skull removed; apply the preservative to both skin and shell, stuff the whole, and glue or fasten on with wire the lower shell. The head may be furnished with a wire, but the other limbs have hardly any necessity for such a support. Give the whole a coat of varnish.

FROGS.

Open the mouth, cut the first vertebræ of the neck, and take out the interior of the mouth with scissors; then raise up both jaws, and pushing back the skin with the fingers of the right-hand, and drawing the body in the contrary direction with the other hand, you will easily remove the skin,—making the body come out at the mouth; put the feet back into their place; no preservative will be necessary. Fill the skin with fine sand, close the mouth, and place it on a board,—giving it the attitude peculiar to its species; some days afterwards, when it is quite dry, give it a coat of varnish. When the varnish is hard, bore small holes under the belly,—through which the sand will escape and leave the body empty, preserving its form.

Frogs lose their colour in drying; they should be dried in the greatest possible haste, and in the shade. The best way of preserving the brilliancy of their tints, is to keep them in spirit of wine.

Lizards must be skinned like mammiferæ; care must be taken that the scales do not come off in turning the skin. They should be well varnished.

Snakes are skinned whole; begin at the mouth, cut round between the skin and flesh inside, and strip off the hide by turning it over. When the jaws cannot be dilated sufficiently for this, make a longitudinal incision at the belly, take out the viscera, cut the body in two, leaving the skin whole; then strip the two portions separate, by turning the skin from the incision to the head and tail. Give the skin a coat of preservative, then of spirit of turpentine, and lastly of varnish.

When reptiles of any sort are preserved in liquid, the phial should be hermetically sealed to prevent evaporation. The best method is that of M. Peron, which consists in using a cork stopple, and the following cement:—

Rosin,
Red Ochre—ground fine,
Yellow Wax,
Spirit of Turpentine.

Melt the wax and rosin together, add the ochre portion by portion, stirring it in with a spatula; after boiling seven or eight minutes, add the spirit of turpentine, and continue boiling.

We have in another part of the work given additional directions respecting the preservation of reptiles in liquid; to those we now refer the reader.

CRUSTACEOUS ANIMALS.

This part will require few details. In very large subjects, the soft parts are removed in the common way. Those no larger than a crab, you may throw into lime-water for two hours; then dry and varnish them.

INSECTS.

You may kill an insect by a little spirit of turpentine, but this must not be applied when there is any thing to be spoiled by it; such as hair, scales, coloured dust—like that of the wings of butterflies, &c. An insect dead and dry for some time, may be softened and put into a good shape, by confining him in a tight vessel, along with damp cotton or sand.

Butterflies. Various methods for preserving these beautiful creatures will occur to the reader, and need not be specified. A good way of keeping them in books, is the following:—Dissolve very white and clean gum in distilled water, adding a little salt; spread this upon very fine paper of a proper thickness; cut off the wings of a butterfly that has been moistened two or three

days; place these upon the paper, leaving space between them for the body; cover and press them tightly, then take off the wings carefully; the brilliant dust will remain attached to the paper, and you will have a beautiful fac-simile of the wings; to which you may add the body by painting.

It is usual to put two specimens of each species of the butterfly kind into the cabinet; one to display the upper, and the other the under side; the under-side is much more beautiful in most species, and differs entirely in appearance from the upper-side.

Caterpillars may be kept in perfect preservation in the following liquid:—

Alcohol,	12 oz
Distilled Water,	1 lb
Corrosive Sublimate,	2 drs
Burnt Alum,	3 oz

Macerate for twenty-four hours; when used, add one-third of water; the phials should be one-third larger in diameter than the insect.

The nests and habitations of insects may be preserved by the application of some of the liquids already mentioned.

SHELLS.

To remove the live inhabitant of a shell, plunge it in spirit of wine for a few moments, and you may draw out the body with a needle or pincers. If it make any resistance, plunge it for two or three minutes in boiling water. These precautions are very necessary, for the smallest fragment of the body remaining will spoil the shell.

The above is recommended only in the case of *univalves*, or those of a single shell,—as cockles; the *bivalves*, or those of two shells, will open on being exposed a few minutes to the sun,—when you may easily remove the muscles and flesh with a knife. They should not be put in hot water, as the ligament which serves the shell for a hinge may be loosened.

Those of the *multivalvular* tribe are more difficult to manage; the best way is to dry up the flesh, and steep the shells in Smith's liquid to keep away insects.

Stains, or incrustations of foreign matter upon a shell, may be removed by warm ley, or diluted aqua-fortis. When rough, they may be polished with emery.

PLANTS.

As soon as you have well dried a plant, lay it upon a sheet of brown, unsized paper; adjust perfectly all its parts, and press it lightly; change the paper every day till every particle of humidity be absorbed, when you may press it as tightly as possible; after this, apply Smith's liquid to every part,—when you may dry it finally in the air.

Some plants have so powerful a vegetating quality, that they revive after drying; plunge these a minute or two in boiling water. Plants are best kept between the leaves of an herbal.

SKELETONS.

All the efforts of man to restore the skin of his own species to its natural form and beauty, have been hitherto fruitless;—the trials for this purpose have only produced mis-shapen, hideous objects, and so unlike nature, that they have never found a place in our collections. We have only some parts of man, either dried or preserved in spirit of wine, sufficiently entire to be recognised. In several museums we see human heads injected, and preserved in oil of turpentine. The anatomical collection of the Museum of Natural

History in Paris, possesses a head prepared in this way more than a hundred years ago, by the celebrated Ruysch, a Dutch physician. It still preserves all the vivacity of its colours; the cold so far affects the liquor in which it is contained, as to hide it completely; but at the return of spring, the liquor becomes clear, and we distinguish the object perfectly.

Anatomists distinguish two sorts of skeletons,—one which they call *natural*, and the other *artificial*.

Natural Skeletons. This sort is the most general, and the easiest to prepare. It is particularly employed for small animals; that is to say, of the size of a fox. Skin the animal, take away the flesh, separating the head only to take out the brains more easily by the occipital hole. The flesh removed, put the skeleton to macerate in water with a little quick-lime added, which has the property of whitening bones. After two or three days, extend the skeleton on a table, and scrape off with a knife the remainder of the flesh. If the solid parts adhere too much, put it again to macerate till the bones are completely cleaned; taking the precaution to preserve all the ligaments which keep the bones together. These ligaments acquire much consistence when dry,

and are sufficient to keep the skeleton upright, when it is a small animal.

Where the ligatures are not sufficient, they should be strengthened with wires; and the whole skeleton must be sustained with stout wire props.

Artificial Skeletons. The skeletons of men, and animals of middling size, cannot be set up in the manner last described. Begin in the same way, by taking off as much of the flesh as possible; but separate all the bones at the joints, before putting to macerate; they should remain longer in the water, on account of their greater size. Renew the scraping until they are perfectly cleaned; then expose them to the sun to whiten, and turn them every day. Bore every bone at the joint, and fasten them together with wires,—leaving a little play at the articulations.

Wire is insufficient for large animals, as the *horse*, *camel*, and *elephant;* for these you must use plates of iron, with screws.

As these vast frames are more often set up for instruction than the gratification of mere curiosity, it is customary to saw the head longitudinally in two, except the under-jaw; the reunion of the parts is effected by a hinge, which permits them to be opened at pleasure, for the study of the interior of the head.

OF EMBALMING.

*Egyptian Method.** The Egyptians had three methods of embalming their dead. The first, which was confined to the poorer classes, consisted in cleaning the corpse with water, injecting it with oil of cedar (probably the essence of turpentine), and preserving it in salt. It was then kept sixty days for drying, after which it was deposited in the tomb.

When the relatives of the defunct were rich enough to pay twenty minæ (about one hundred dollars of our money,) to the public officers charged with the duty of embalming the dead, the body was taken four days after decease;—they began by cleansing the body; then, by means of a syringe, they injected oil of cedar within, but made no incision in the body; this sufficed for the decomposition of the entrails. It was then salted with nitre, and left for sixty days; after which, the decomposed viscera were taken out, and the space filled up with nitre.

* Besides the Egyptians, it appears that the ancient Gauls were in possession of some art of this sort, now unknown to us. There has been found in the mountains of Auvergne, a body in perfect preservation, embalmed in the Egyptian manner. It is now in the Cabinet of Comparative Anatomy, at the Jardin des Plantes in Paris.

The relations then took charge of the body, and completed the desiccation.

The third method was employed upon sacred animals, princes, and persons sufficiently wealthy to pay a talent (five hundred dollars) to the embalmers. The relatives of the dead entrusted the body to the public officers for seventy days, on common occasions; but during an inundation of the Nile, it was customary to wait till the river had subsided. One of the officers took the body, and extending it upon the ground, marked a spot for incision in the left side; another cut the opening with a sharp Ethiopian stone,—and immediately taking to flight, was pursued by the people with loud curses and volleys of stones.

Others then by the help of irons drew out the brains at the nostrils and an opening in the eye, filling up the cavity with aromatic drugs. From the incision in the side they took away the viscera, and cleansed the cavities with palm-wine; they then filled up the body with myrrh, cinnamon, and a variety of other drugs, but were careful not to make use of incense; the body was then sewed up, and covered entirely with *natron* for seventy days;—the *natron* must have been a fixed alkali, and not *nitre* as some have asserted.

After this, the body was carefully washed, and every cavity filled anew with drugs, aromatics,

bitumens, and resinous matter. Before sewing up, several articles were introduced into the body, as amulets, or superstitious tokens; these were — a little bronze statue, with the legs joined, the hands crossed over the breast, a hood upon the head, and covered with hieroglyphics,—a book, medals, small vases, &c.

Thus prepared, a piece of money was put in the mouth, the nails and teeth were gilded, and the whole body received a thick coat of Judean bitumen, dissolved in oil of cedar; it was then wrapped in several bandages of linen cloth; after this, a second coat of the bitumen was applied, and then additional bandages,—proceeding thus till the whole had reached a sufficient size. It was then covered with amulets and bands of gummed cloth, upon which hieroglyphics were painted.

Embalming Birds. There are some advantages attending this method of preservation,—the skeleton is saved, and may serve for anatomical study when the bird is destroyed by time or the insects. Place the bird upon the back, and make an incision from the neck down; skin right and left as far as you can, without cutting the joints of the wings or legs; take away the entrails, the muscles, and all soft parts, but spare the ligaments of the joints. Extract the eyes carefully,

that the vitreous humour may not soil the feathers; then by one of the sockets draw out the brain with an ear-picker. Remove from the bill all soft parts, as the tongue, larynx, &c; in fine, make the bird a skeleton in all respects but the skin. Then apply the preservative in all parts, and arrange the wires to keep him in position.

This done, sprinkle upon all parts the powder mentioned in page 88; the whole bird should be covered with it. Stuff chopped cotton into the cavity of the brain, and any proper material into the body; then sew up, and arrange the eyes, &c.

The above practice, however, is little pursued; it is more tedious and difficult than the common method. The preservation of the skeleton has not been thought an object sufficient to compensate for the additional labour.

METHOD OF MAKING ARTIFICIAL EYES.

The eyes of animals being the organs by which they best express their dispositions, they demand the particular care of the naturalist. The instruments necessary for their fabrication are—an enameller's table, blow-pipe, lamp, round pincers about six inches long, which close by means of

a ring, and which hold the iron wire forming the means of support; another flat pair of pincers of the same length, which serve to handle the enamel when necessary, and at the same time to stir up the lamp.

The materials are—an assortment of small cylinders of enamel of all colours, and clippings or fragments of looking-glasses which you melt by the lamp into a sort of small cylinder like the enamel before using it. Take care in melting these pieces of glass, to free them from all spots and globules of air. When furnished with every thing put the table in an obscure place, that the light from elsewhere may not overpower that of the lamp. The lamp well lighted, direct the blow-pipe toward the middle of the wick, which scatter a little in that part and procure a clear bluish flame, to which you will expose the enamel you wish to melt. If this flame be not clear and lively, the colours of the enamel are apt to change, and the operation fails. Practice alone teaches the proper degree of flame; but it is generally better to expose the enamel to the extremity of the jet of the flame,—where it never burns, and frequently melts more easily than in the centre.

Small eyes being the least difficult, you should begin upon them. For these, take a small iron wire an inch and a half in length, and hold one of

the extremities in the round pincers, whilst you approach the other to the fire,—to which expose at the same time, the enamel of the colour you wish to make the eye, turning it between the fingers until it begins to melt; then fasten the quantity necessary for the size of the eye to the end of the wire,—it will form a little globe on being turned in the flame; when it is well rounded, place in the centre a little speck of black enamel, to form the pupil. Again expose it to the fire, that this pupil may be incorporated with the mass,—and when it is well incrusted, put some glass upon it, which should extend at least over three-quarters of the hemisphere; it is this glass, which by representing the vitreous humour of the eye, gives it all its brilliancy.

Continue to expose the eye to the fire, until the glass has equally extended over that part of it which is to form the iris; this done, let it cool slowly.

Eyes of the largest size should be blown. Take a pipe of baked earth, or a tube of glass, from 6 to 7 inches long; to the end of this put a little white enamel, which present to the fire in order to blow it. This enamel forms a globe, larger or smaller according to the air you introduce; the globe being of the proper size, place in the middle, and perpendicularly to the point of the pipe, the quantity of enamel necessary to

make the iris; incorporate the second enamel with the first, by presenting it to the fire,—taking care to turn the pipe with the fingers, that the enamel may spread equally, and the iris be exactly round. If the iris is to be of several colours, as for example that of man, distribute in diverging rays several little threads of suitable enamel; present the eye to the fire, until you have incorporated the iris,—after which place the pupil, heat it in the same way, and then apply the glass. As it is almost impossible that the eye should not sink down in the course of this operation, and that the air introduced should not escape as much by the heat as by the pressure used above in applying the different substances, take care from time to time to introduce it afresh that it may not lose its form. This is especially necessary when you apply the glass, and it is extended over the whole surface of the iris.

After having given the eye its size and form, take away the pipe; to do which, after the air has been introduced, stop the entrance of the pipe with the finger, and expose the back part of the eye to the fire,—and the air contained in the globe, and ramified by the pipe, comes through at the place where the fire has most action. Prolong this opening, by turning the point of the flat pincers or an iron wire all round the pipe,—leave but one point by which the eye remains fixed;

warm it equally all over, after which expose it to a gentle heat; and when it is cold again, separate it from the pipe.

For very small eyes, a drop of black sealing-wax will be found sufficient. Glass and enamel eyes of all sizes are sold at the shops in London and Paris.

GENERAL REMARKS RESPECTING THE PRESERVATION OF SUBJECTS OF NATURAL HISTORY.

Rooms for containing these objects must be perfectly dry; they may face east or west, but never south. Nearly all preparations are subject to discoloration by the light; the cases containing them should therefore be furnished with curtains and shutters, which should never be drawn except when necessary; a ray of the sun must never be admitted. In damp weather a stove is requisite,—indeed too much precaution can hardly be taken to defend every thing from moisture; a collection of animals exposed to the damp for a year, is ruined beyond reparation; a collection of plants will totally spoil by dampness in a month,—the leaves and flowers fade and become of a tobacco colour, long before any other trace of humidity is discernible.

Minerals are also in danger from dampness; their tendency to combine with the gases of the atmosphere, causes speedy oxidation and efflorescence.

Dust is also injurious, and should be carefully excluded from a cabinet by making every joint and opening perfectly tight,—this will have the additional use of keeping out insects; a good method is to have the doors *listed*, or lined at the joints with cloth; this however must be of cotton or linen,—never of woollen, or any animal substance, on account of its tendency to attract insects.

Every month, particularly in the spring, a collection should undergo a thorough examination; when you suspect an animal to be attacked by insects, beat it with a stick and apply Smith's liquid.

When reptiles are attacked by insects, give them a plentiful appliance of spirit of turpentine.

When flies have deposited their eggs upon the lips of a quadruped, apply the same.

With regard to those kept in liquid, you have only to fill it up as fast it evaporates.

Fishes lose their colours by the light quicker than any other subjects; they should in consequence be kept in the darkest parts of a cabinet.

Testaceous subjects require occasionally a little spirit of turpentine upon the ligaments or hinges of the shells.

An herbal should be examined every month; when a plant or flower grows of a darker colour, it requires a new drying. If insects make their appearance, use Smith's liquid.

When an animal is attacked by insects, you may kill them by the heat of an oven; if the animal be too large for this, fumigate him with sulphur for some hours, during which time he should be tightly covered in: you may do this by placing him under a wooden box, and burning a quantity of sulphur underneath in an earthen pan. A very dry time is absolutely necessary for this operation; any dampness would in conjunction with the sulphur seriously injure the colours of the animal.—Remark, that this treatment is improper for birds.

Insects are kept in shallow drawers, or more advantageously as regards appearance, in frames covered with glass; upon the floors of these they are stuck with pins through bits of cork or the pith of alder, upon which they rest. When you see a yellowish dust gathering upon an insect, you may be sure he is attacked; if he be of the coleopterous tribe, steep him for a few hours in Smith's liquid or alcohol, and when dry apply a coat of the essence of wild thyme;—a piece of

camphor wrapped in a cloth has the same effect, but this should be renewed every six months.

OF GROUPING.

By this term, we understand the arrangement of two or more subjects together, so as to represent an action; such as—a falcon grasping a dove within his talons,—a partridge covering her brood with her wings, in defending them from the attacks of a weasel or hawk,—a pair of doves perching and billing upon a rose-bush,—a mocking-bird essaying a vain defence against the fangs of a snake, who is thrusting his head into her nest, &c. Compositions of this sort form a striking and interesting kind of picture, when they are arranged with taste and skill. To this end, the operator should be able to bestow upon each individual, the attitude and expression fitted to denote the particular emotion which he is imagined to feel,—as rage, grief, ferocity, love, &c.

Animals have passions like men, and though less in number, they are more energetic; we shall subjoin a short extract from Boitard's work, entitled the *Cabinet of Natural History*, in describing the effects of some of the passions, as witnessed in a few individuals of the feathered

tribe; in this he refers to three very common and well known species, namely, the magpie, the blackbird, and the wren.

'*When in a state of repose*, the feathers of the magpie on the upper portion of the body are smoothed flat to the skin; those of the belly slightly raised from it, which makes them a little pendent; the neck drawn in, the tail parallel with the body or but slightly inclined, and the wings fixed in their pectoral cavities; when in this condition, the magpie is always perched.

'The blackbird's feathers when in repose are a little disordered, the neck drawn quite into the breast, the tail somewhat raised, and the wings in a small degree pendent. He should be perched.

'The feathers of the wren are smooth, and the tail parallel. He is always perched.

'*In action*, the body of the magpie is placed horizontally; the neck stretched out, the head turned aside, the feathers all smooth, and the tail raised high; the legs are placed near the middle of the body, and the wings pendent; he may be placed not perching.

'The blackbird's feathers are disordered, the neck a little stretched, the head straight forward and a little raised, the tail set high, the legs bent as if unable to support the body, and the wings very pendent; he may be placed not perching.

'The feathers of the wren are smooth, the tail raised to a vertical position, the neck considerably stretched, the bill pointing downward, the wings pendent, the legs stretched out, and the body parallel to the horizon.

'When a bird is in fear, the neck is stretched out, the feathers flattened very smooth; the beak, the body, and the tail in the same line, and a little hanging forward; the forward extremities of the wings are detached from the body, and the tips close to the tail.

To give a bird the attitude of seizing on its prey, stretch the legs, open the claws, bend down the neck and head, raise the wings high, about three-quarters open, and convex above; the tail should form a fan, almost perpendicular, and the body be inclined towards the prey.

'If the bird be flying, the tail should be horizontal and open, the neck forward and a little on one side, the claws shut and pressed against the breast. Suspend it to the ceiling by a wire or string.

'In the transition from fear to anger, the body inclines still farther forward; the beak opens; the pupils of the eyes draw toward each other, and give the bird a squinting look; the feathers of the neck ruffle up,—those of the lower parts lie flat; the tail rises, and spreads in an arch; the legs bend; and the wings are thrust

off from the body—or half open, and rise upon the back.'

The operator cannot be ignorant of various materials necessary for composing his groups; still there are many things in so general use, that we shall present them to notice here.

The branches upon which birds are generally placed in cabinets, are gathered upon the skirts of woody spots; they are commonly the limbs of plum-trees, which have been stunted by the bite of cattle, and become covered with white and yellow lichens; the branch, fixed in the cabinet, is adorned with artificial flowers and leaves, fastened on with wire. To imitate the various sorts of mosses, lichens, and short grasses, it is customary to use the fine shavings of horn made by turners; these are coloured according to fancy, and sifted over the branch—which has previously been coated with glue or paste. An imitation of rock is effected by brown pasteboard, wetted in thin paste, moulded into a proper shape, and covered with fine sand. Earth is imitated with sand, gravel, coffee-grounds, &c.

Beyond these general ideas, the operator must be left to the guidance of his own taste and ingenuity; groups of the above description possess value both for use and ornament; when arranged with skill and effect, they constitute alike objects of scientific study and elegant taste.

ON THE MANAGEMENT OF INSECTS.

Insects are distinguished from other animals by the wonderful changes that all, except those of the seventh class (aptera), pass through.

Ancient writers were not acquainted with the transformations of insects, as appears very plainly by the erroneous suppositions generally entertained; neither was the mystery entirely explained till the latter end of the last century, when *Malpighi* and *Swammerdam* made observations and experiments on insects, under every appearance,—and by dissecting them just preceding their changes, were enabled to prove, that the moth and butterfly grow and strengthen themselves, and that their members are formed and unfolded, under the figure of the insect we call caterpillar.

The succession of its transformations are,—the larva or caterpillar is hatched from the egg; from the larva, it passes into the pupa or chrysalis state; from the pupa or chrysalis, into the imago or fly state.

The Egg. The eggs of an insect are always small, compared with the size of the insect itself; they vary in number and figure in different spe-

cies; some are round, others oval; some are cylindrical, and others nearly square; the shells of some are hard and smooth, while others are soft and flexible. It is a rule, but is not invariable, that the eggs never increase in size after they are laid.

They are found of almost every shade of colour, and are always disposed in those situations where the young brood may find a convenient supply of proper food; some insects deposit their eggs in the oak-leaf, producing there the red-gall; others cause a similar appearance on the poplar-leaf; and the red protuberances on the willow-leaf, and the termination of the juniper branches, are produced by like means; the leaves of some plants are drawn into a globular head by the eggs of an insect lodged therein;—and many curious circumstances relative to this economy might be noticed, if the nature of our plan would permit.

The phryganea, libellula, gnat, ephemera, &c, hover all day over the water to deposit their eggs,—which are hatched in the water, and remain there all the time they are in the larva form. Many moths cover their eggs with a thick bed of hair which they gather from their bodies, and others cover them with a glutinous composition, which, when dry, protects them from moisture, rain, and cold; and the wolf-spider carefully

preserves its eggs in a silk bag, which it carries on its back; by some moths they are glued with great symmetry round the smaller branches of trees, or are secreted beneath the bark, and frequently in the crevices of walls, in hollow stalks, &c.

The Caterpillar. All caterpillars are hatched from the egg, and when they first proceed from it are small and feeble, but their strength increases in proportion with their size; a distinguishing character of the caterpillar of a lepidopterous insect is, not having less than eight nor more than sixteen feet.

The caterpillar, whose life is one continued succession of changes, moults its skin several times before it attains its full growth; those changes are the more singular, as it is not simply the skin which is cast off; but with the exuviæ we find the skull, the jaws, and all the exterior parts, both scaly and membranaceous, which compose the lips, antennæ, palpi,—and even those crustaceous pieces within the head, which serve as a fixed basis to a number of muscles, &c.

The new organs are under the old ones, as in a sheath; so that the caterpillar effects its change by withdrawing from the old skin, when he finds it inadequate to its bulk.

Those caterpillars who live in society, and

have a nest, retire there to cast their exuviæ,—fixing the hooks of their feet firmly in the web during the operation. Some of the solitary species spin at this time a slender web, to which they affix themselves. A day or two before the critical moment for its moulting, the insect ceases to eat, and loses its usual activity; the colours gradually become weaker, and the caterpillar more feeble, the skin hardens and withers, the creature lifts up its back, stretches itself to the utmost extent, sometimes elevates its head, moving it a little from one side to another, and suddenly letting it fall again; near the change, the second and third rings are seen to swell considerably,—and by repeated exertions a slit is made on the back, generally beginning on the second or third ring; through this division the new skin may be just perceived by the brightness of its colours; the creature presses through like a wedge, and thereby separates the skin from the first to the fourth ring, which sufficiently enlarges the aperture to admit the caterpillar through.

The caterpillar commonly fasts a whole day each time after repeating this operation; some caterpillars in changing their skins, from smooth, become covered with hair; while others, that were covered with hair, have their last skin smooth.

The food of caterpillars is chiefly or entirely

of the vegetable kind. The larvæ* of beetles live under the surface of the earth, and prey upon smaller insects, on the roots and tender fibrils of plants, or on filthy matter in general; indeed, in the last state, bettles are most commonly found in putrid flesh, or in the excrements of animals.

When the caterpillar has attained its full size, and all the parts of the future moth, or butterfly, are sufficiently formed beneath the skin, it prepares to change into the chrysalis or pupa state; some spin webs, or cones, in which they enclose themselves; others descend into the earth, and conceal themselves in little cells, which they form in the light loose mould; some are suspended by a girdle, which passes round the body, and is fastened to the small twigs of trees; and caterpillars of butterflies connect themselves by their posterior extremity to the stalks or leaves of plants, with their head downwards.

The length of time insects live in the state of caterpillars, is always the same in each individual species,—yet very few species precisely agree to the same period for their changes; some live two or three years, others only a few months, or

* *Larva* is a term usually applied to the second state of all insects, except those of moths and butterflies, which are called caterpillars.

even weeks, before they pass to the pupa or chrysalis state.

Preparatory to the change, the caterpillar ceases to take any of its food, empties itself of all the excrementitious matter that is contained in the intestines,—voiding at the same time the membrane which served as a lining to these, and the stomach; and perseveres in a state of inactivity for several days. At length, by a process similar to its former moulting, the outer skin, or slough, is cast off; and the creature thus divested of its last skin, is what we call the chrysalis.

Pupa, Chrysalis, or Aurelia. The words aurelia or chrysalis are equally used, to express that inactive state which ensues after the caterpillar has changed, for the great purpose of preparing for the *imago*, or transformation to the fly. Aurelia is derived from the Latin *aurum*, and chrysalis from the Greek, and are both intended to signify a creature formed of gold; this however is giving a general title from a very partial circumstance, as the colour of a considerable number are black, or dark brown, while the resplendence of gold is only seen on the chrysalides of a few species of the papilio or butterfly. The term chrysalis should therefore be used to signify only those of the butterfly kind, and pupa for

the phalænæ, or moths, as well as those of sphinxes, or hawk moths.

That very intelligent naturalist, M. de Reaumur, explains the cause of this brilliant appearance; it proceeds from two skins, the upper one a beautiful brown, which covers a highly-polished smooth white skin; the light reflected from the last, in passing through the uppermost, communicates this bright golden yellow, in the same manner as this colour is often given to leather, so that the whole appears gilded, although no gold enters into that tincture.

The exterior part of the pupa is at first exceedingly tender, soft, and partly transparent, being covered with a thick viscous fluid, but which drying forms a new covering for the animal.

The time each insect remains in this state is very easily ascertained by those who once breed them, as they always remain the same space of time, unless forwarded or retarded by heat or cold, but in different species they vary considerably; for example, the *Papilio Atalanta (Red Admirable)* remained only twenty-one days in chrysalis, from the 12th of July to the 3d of August, but the *Phalæna Oo. (Heart Moth)* remained from the beginning of October till May following; and many species remain a very considerable time longer than this.

When the insect has acquired a suitable

degree of solidity and strength, it endeavours to free itself from the case in which it is confined; and as it adheres to a very few parts of the body, it does not require any great exertion to split the membrane which covers it; a small degree of motion, or a little inflation of the body, is sufficient for the purpose; these motions reiterated a few times, enlarge the opening, and afford more convenience for the insect's escape; this opening is always formed a little above the trunk, between the wings and a small piece which covers the head. Those species which spin a cone, gnaw or pierce an aperture large enough for their emancipation.

The moth immediately after emerging from its case is moist, with the wings very small, thick, and crumpled; but they rapidly expand under the eye of the observer, and in a few minutes have attained their full size; the moisture evaporates, the spots on the wings, which at first appeared confused, become distinct, and the fibres, which were before flexible, become stiff and hard as bones.

When the wings are unfolded, the antennæ in motion, the tongue coiled up, the moth sufficiently dried, and its different members strengthened, it is prepared for flight. The excrementitious discharge which is voided by most insects

at this time, M. de Reaumur thinks is the last they eject during their lives.

Insects are collected in every state, though in the caterpillar, or chrysalis, they are preferred, not only as the time of their appearance in the winged state may be then carefully attended to, but they will not be so liable to disfigure and damage their tender markings, as those which have been in the wind or rain; and if they are taken with care from the breeding-cage immediately after their wings have attained a proper size, they may be preserved free from any injury to those beautiful feathers, which are generally much discomposed in such insects as are taken in flight.

There are some which cannot be found in the caterpillar state; or if found, cannot be provided with food; those are generally of that kind which collectors term internal, or underground feeders, and either subsist on some substance unknown to us, or which we cannot readily supply. The larvæ of beetles and many other kind of insects, are of this description; numbers of the moth tribe have hitherto only been taken in the fly state, and are supposed to feed in the night; they live in cells which they form in the earth, and come up in

the evening to feed, but descend again into their cells before daybreak; it is therefore that some Aurelians have sought for caterpillars by the light of a candle or lantern, and have been very successful; the most valuable insects have been discovered by this means.

Insects are found in almost every situation; the summits of the loftiest trees, and the lowest herbage equally abound, and the gradations between swarm with an infinity of species; the collector must be therefore supplied with a different apparatus, according to the state in which the insects may be found.

To collect caterpillars, it is only necessary to expand the fowling-net, or a large sheet, under the branches; then beat them with a stick or pole, and the caterpillars will be shaken down with the fragments of the foliage and broken twigs.

When you have procured the caterpillars, be particularly attentive to note the plant on which you found each species, and supply them plentifully with fresh food every day of that kind; only observe if they are moulting they must not be disturbed, nor the stale food be removed, but give a fresh supply when the creature has recovered its strength.

Insects in this state are rarely found on plants which do not afford nourishment to their species;

but it sometimes unfortunately happens that stragglers are taken on some particular herbage, altogether of a different nature to its proper food; and indeed in some cases the most skilful practical entomologists are deceived; the caterpillar refuses to eat of the proffered plant, and dies. Some* will devour indiscriminately the leaves of almost every species of plants, and are therefore called general feeders; some† are more limited in this particular, but feed on several kinds; others‡ are designed to eat the leaves of two or more plants, and a few subsist on one species only.‖

Neither can any certain criterion be formed as to the part of the plant, for though most caterpillars devour the leaf, some subsist on the roots;§ others on the buds,** flowers, fruit,†† and indeed on every other part‡‡ of the plant, shrub, or tree.

* As the *Phalæna antiqua*, vapour moth; and all the tigers.

† *Phalæna pavonia*, emperor moth; on the rose, bramble, fruit-trees, &c.

‡ *Phalæna verbasci*, water betony moth; on the mullein and water-betony.

‖ *Papilio vurticæ*, tortoise-shell butterfly; on the nettle.

§ *Phalæna pronuba*, large yellow underwing; on the roots of grass. *Phalæna humuli*, ghost; on the roots of burdock.

** *Phalæna salicella*, rose moth; on the rose-buds.

†† *Phalæna pomonella*, codling moth; on the apple.

‡‡ *Phalæna psi*, gray dagger; bark of fruit and willow

It is not always possible, if one kind of food cannot be procured with convenience, to determine from the quality of that food, what other kind will best suit the creature; sometimes plants of the most opposite nature have nourished the same caterpillar. The *phalæna antiqua* has devoured leaves of the thorn, and of the rose; and has throve well when fed on the poisonous laurel and the deadly nightshade.

They should always have an abundance of food, for some kinds devour a very considerable quantity in a few days; the *papilio brassicæ*, cabbage butterfly, eats in one day twice its own weight of food.

Doctor Lodovico Bellardi, a learned and ingenious botanist of Turin, discovered some years ago, after a number of experiments, a new method of feeding silk-worms, when they are hatched before the mulberry trees have produced leaves, or when it happens that the frost destroys the tender branches. Whether this discovery may be applied with equal propriety in other instances seems at present undetermined, though from some recent experiments we are inclined to believe the possibility of feeding caterpillars in backward

trees. *Sphinx apiformis;* on the internal part of the wood poplar. *Phalæna Cossus*, Goat; on the internal part of the wood of most trees.

seasons in this manner; we have tried several caterpillars which were nearly full fed on the leaves of thorns and oak so prepared, and have observed them to eat it when no other food was given, but cannot say how they may thrive if fed on that aliment alone. This new method consists in giving the caterpillars the dried leaves of their usual food, powdered and moistened; and repeated experiments, says our author, prove that they (the caterpillars of silk-worms) prefer it to any other, and eat it with the greatest avidity. The leaves must be gathered about the end of autumn, before the frost commences, in dry weather, and at times when the heat is greatest. They must be dried afterwards in the sun, by spreading them upon large cloths, and laid up in a dry place after they have been reduced to powder. When it is necessary to give this powder to the caterpillars, it should be gently moistened with a little water, and a thin coat must be placed round the young worms, who will immediately begin to feed upon it.

THE BREEDING CAGES

May be made of deal, with a frame door covered with gauze or crape, to admit fresh air; and a hole in the bottom through which the stalks

of the plants may be put into a phial of water to preserve them fresh.

Those cages should never contain more than one kind of caterpillar, as some species devour others; and indeed, if left without food, will devour those of their own kind also.

Let not the boxes which are taken in the pocket for caterpillars, nor the cages made for breeding insects, be made of deal or fir, except they be well lined with paper; for the effluvia of the turpentine, raised by the heat of the pocket, or that of the sun, is extremely prejudicial to them, and seldom fails to destroy the greatest part of the caterpillars contained therein for any length of time. The cause of the deaths of the caterpillars found at the bottoms of cages or pocket boxes, is generally attributed to bruises got in beating the trees for them at the time of collecting them, which is a great mistake, as those which happen to be injured in beating, seldom die till the time of changing their skins, or of their transformations, and will nevertheless eat heartily till either of these times approach. If the inside of the cages or boxes be well lined with paper, as aforesaid, and air-holes made in the sides and tops, covered with crape, canvas, &c, to admit air, it will in a very great measure prevent the above ill effects.

Put a small quantity of moist earth, about an

inch deep, at the bottom of every cage, but if the caterpillars are large, more in proportion; always allowing a sufficient quantity for them to bury in.

The cages must never be exposed to the scorching rays of the sun; on the contrary, place them in some cool, shady situation.

The chrysalides should be preserved in some cold or moist place in the winter; for by being kept too dry, the earth about them will absorb the nutritive moisture from the animal, thereby not only weakening it, but hardening the shell, so that its strength will be insufficient to burst open the case when it should come forth; and thus enclosed it must perish miserably.

The larvæ of many insects that feed beneath the surface of the earth, may be bred by the Aurelian in the following manner:—let any box that is about three or four feet square, and two or three feet deep, be lined or covered externally with tin, and bore through the sides and bottom a number of very minute holes: put into this box a quantity of earth that is replete with such vegetables as you are certain the caterpillars subsist on, and sink it into a bed of earth, so that the surface may be exposed to the different changes of the weather, unless the sun is very hot, or the rain heavy; you may then put the caterpillars

into the box, and to prevent their escape, cover the opening with brass or iron net-work.

PUPA.

We have before observed, that insects taken in this state are most likely to be perfect and vigorous; and are therefore more generally sought for by Aurelians, than even when in the caterpillar state. Some chrysalides are buried in the earth; some penetrate into rotten wood; and some lie concealed underneath the bark of trees.

An instrument after the form of a hoe or trowel is used when you search for those of the first kind; and the only places worthy attention are at the roots of trees, as oaks, elms, &c, or beneath the underwood: open the earth close to the tree, and search to the depth of several inches.

Such as penetrate into wood, require more care lest they be destroyed when the attempt is made to extricate them; sound on the bark with a stick, and you will discover hollows where no external signs are visible; tear off the bark, and with a knife cut away the wood that surrounds the orifice of the cavity to enlarge it, and take out the chrysalis as carefully as possible.

Whether found in the wood, or adhering to the inside of the bark, it should be preserved in the same substance in the breeding-boxes; and if found spun up on the branches of trees, or in the mould, manage to adjust them in a similar manner in the boxes.—They must be handled as little as possible, and be very careful not to press on any part; as the least rough treatment will either kill or cripple the insect within.

Swammerdam used to hatch the eggs, feed the larvæ, and preserve the pupa of aquatic insects, in a shallow dish, which he covered with white paper, occasionally moistened, and pierced in several parts for the admission of air.

SETTING AND PRESERVING OF INSECTS.

Collectors are generally satisfied, if they can obtain the insect in its last, or fly state; but as a few instructions for the preservation of the egg, caterpillar, and chrysalis, may induce some future naturalists to enrich their cabinets with such specimens, in addition to the insect itself, we have selected a few particulars for their purpose.

The Egg. The eggs of most insects retain their form and colour well, if preserved in the

cabinet, but those which do not promise fairly, may be prepared after the method practised by Swammerdam; he used to pierce the eggs with a very fine needle, and press all the contained juices through the aperture; then inflated them until they regained their proper form by means of a small glass tube, and lastly filled them with oil of spike, in which some resin had been dissolved.

The Caterpillar. The preservation of insects in this state, is not only one of the most curious but useful discoveries that have been made in this department of science. They may be preserved by being plunged into phials filled with well rectified spirit of wine; this method should ever be preferred by those who collect in a distant country, if their subjects are not likely to be injured by such a process; the most delicate caterpillars will retain their exact size, but the spirit will generally extract the colour, and from those especially which have very tender skins.

But the manner in which Swammerdam preserved his caterpillars, completely obviates this defect; and if carefully managed, it not only preserves the exact size, but generally retains the colours as perfectly as in the living creature.

He used to make a small incision or puncture

in the tail, and having very gently and with much patience pressed out all the contained humours, injected wax into them, so as to give them all the appearance of healthy living insects. In this manner he has preserved many very small specimens.

There is another method, which is more generally known to collectors; it consists in taking out all the inside of the caterpillar, and inflating the skin by means of a glass tube.

The entrails, with whatever of the fleshy substance can be removed, are drawn through the anus by means of fine wire curved at the end; when the inside is emptied, the glass tube is inserted into the opening, through which the operator continues to blow while he turns the skin at the end slowly round over a charcoal fire; this hardens the skin equally, and dries up all the moisture within; a pin is then put through it to fix it in a standing position: if the skin is tender, it may be filled with white paper or cotton.

But this is a most cruel operation on the little victim, and such as must shock the feelings of the human soul; if therefore any other method can be introduced which will effect the purpose in a short time, the practice should be exploded as wanton barbarity.

Various attempts have been made, and among these some have tried to drown the caterpillar;

but you will never be able to accomplish its death in this manner, unless it remains for a considerable time under water, and though it may appear dead, the principle of life will not be destroyed. Mr Bonnet, making experiments on the respiration of insects, had one caterpillar which lived eight days with only two of its anterior spiracula in the air.

The method we wish to recommend is to observe when the caterpillar is on the point of casting its last skin; drop it by the threads into scalding water, and quickly withdraw it; the creature will be killed instantly; then put it into some distilled vinegar mixed with spirit of wine, which will give a proper firmness to all the parts, and accelerate the separation of the skin from the body; the flesh may be carefully extracted, and the exuvia or skin be blown up by means of a glass tube while suspended over a charcoal fire, as before described.

Anoint it with oil of spike in which some resin has been dissolved, unless it is a hairy caterpillar.

The Pupa or Chrysalis. When insects have quitted the pupa state, the case will require only to be put into the drawers or boxes with some camphor, but those which have the insects within

must be either dropped into scalding water, or inclosed in a small chip box, and exposed to the heat of a fire, which will shortly kill the insect within.

If those chrysalides which have the appearance of gold are put into spirit of wine, they will always retain that colour, but if the insect within is killed first, or if the fly has quitted it, such appearance is entirely lost.

THE LAST OR PERFECT STATE.

Coleopterous Insects, or Beetles. The preservation of this order of insects, is attended with very little difficulty.

If you drop them into scalding water they die in an instant, but the moisture they imbibe can never be sufficiently exhaled to prevent mouldiness, after they have been a short time in the cabinet.

The best method is to enclose them in a small chip box, and kill them by exposing the box to the heat of a fire; this treatment will rather absorb, than add to the superfluous juices of the insect, and greatly contribute to its preservation.

Those of the *meloe* genus have soft, tender bodies, which shrivel after death; to preserve

those, make an incision at the extremity of the abdomen, probe out the entrails, and fill the cavity with fine tow.

Several foreign species of cassida, and many other coleopterous insects, are beautifully variegated with a golden colour that dies with the creature; if you plunge them into well rectified spirit of wine, when alive, they soon expire and retain their golden appearance; but if taken out and dried, that brilliance will be irretrievably lost.

The Chinese seldom take care to display the parts of their insects after the European manner; those we receive from China are stuck on long needles; if beetles, often through one elytra, so that the membranaceous wings are entirely concealed.

If the insects require only a little relaxation to extend the parts, use a camel's-hair pencil moistened with spirit of wine; but if this should prove insufficient, fix them on a piece of cork and float them in an earthen pan half filled with water; it is better to cover the pan with a damp cloth, and the insects will be so limber, after a few hours, that they may be reset in any position.

Large beetles are usually stuck through one of the shells, but smaller insects are better if displayed on a small piece of card (they must be

fixed to the card with strong gum); or they may be pierced through the head.

Insects of the hemiptera order, as cimices, &c, may be treated in the same manner.

LEPIDOPTEROUS INSECTS,—AS BUTTERFLIES, HAWK-MOTHS, AND MOTHS.

Sphinxes and moths are generally disposed in pairs to show the male and female, and as their under sides are seldom very beautiful, only their upper sides are shown.

Except a few species, moths constantly conceal their under wings when at rest; but collectors sacrifice the propriety of their remaining in a natural position, in order to display the under wings.—It is advisable to have one of every kind in a natural posture, as that will often essentially assist to determine the family of the insect.

Provide a quantity of card-braces, and a board of a convenient size, covered with soft cork; it must be perfectly even on the surface, and papered; this is termed the setting-board.

For small moths it is only necessary to put the pin through the thorax and they die in a very short time; but for larger kinds, the pin should

be dipped in strong aqua-fortis before it is put through the insect.

It is very difficult to kill the largest kinds of moths and sphinxes:—select a large pin (comparatively for the size of the insect) and dip it into aqua-fortis as before, but immediately that the pin is forced through the thorax withdraw it, and put a drop of aqua-fortis into the wound; should this prove insufficient to kill it, put the point of the pin through a card, and hold it in the flame of a candle until it becomes red hot; this will kill the insect immediately, and the card will protect it from being injured by the flame.

The moth is then to be fixed on the setting-board. The wings are to be carefully displayed by means of a large pin, and the braces put close down to prevent their return to the natural position.—*Note*, All insects must be set while they remain limber, for if the parts stiffen they are apt to snap; they may be relaxed by floating them in a pan of water.

Insects should remain beneath the braces on the setting-board until all the aqueous moisture be evaporated, or the wings will start from their position, and the bodies turn black, or mouldy; they should be placed in a dry situation, and be covered with gauze for the admission of air for

the space of a month at least, before they are put into the cabinet.

It is proper in this place to caution the young beginner not to attempt to kill the insects by fumigations of sulphur, &c, a practice too frequent with persons of this description, for should he by this means deprive the creature of its life, he will also deprive it of its beauty. It is even doubtful whether many may not survive the operation.

M. Lyonet placed several of the large musk beetles, probably the *cerambyx moschatus*, under a glass where he had been burning sulphur, and which he kept burning while they were there; and though the vapour was so thick that he could not discern them, and that he kept them therein more than half an hour, they did not seem in the least incommoded.*

Some moths are very liable to change colour when placed in the cabinet, and particularly those which collectors term *full-bodied*; an oily matter is common to all insects, but those are charged with a superabundance. It appears at first in spots on the body, but gradually pervades every part; in some it will even descend into the wings,

* Lesser, Theologie des Insectes, tom. i, p. 124. Ibid, p. 126.

and then an obliteration of all the tender marks and beautiful specklings is the least that may be expected, if a total change of its colours, to an uniform dirty brown, does not ensue. Hence it is that many of the Linnæan descriptions of insects appear defective to such as breed them; we not unfrequently read, *body black*, though we know that part of the insect is white in every specimen that is not greasy; the body of the satin moth is perfectly white when fine, but after it has been killed some time, it becomes black in parts; the body of the burnet sphinx is of a very brilliant blue colour, with yellow bands on every annulation, when alive, but changes to a velvety black soon after the insect dies; the same is observed on the body of the currant sphinx; and every part of the body of the hornet sphinx changes to a jet black, after being some time in the cabinet; although when alive it is a very bright yellow, with a band of purple. Hence also it is that some specimens of very common insects are valuable, by having preserved their proper colours uninjured.

Various methods have been tried to extract the grease from the moths, but a preventative should always be preferred.

If the grease has not spread into the wings,

the insect may sometimes be cured, but it will be very difficult, if not impossible, to eradicate the grease which has settled in patches on the wings.

Large moths are to be opened in a straight line along the under side of the body, the entrails, &c, taken out, and the cavity filled with fine tow or cotton.—This should be performed soon after the insect is dead. The most delicate specimens may be preserved entire by this means.

Sometimes it will be proper to break off the body close at the thorax, and substitute the body of another insect which nearly resembles it, and which is not so liable to change.

The method which is most successful for recovering the original appearance after the insect has become greasy, is to powder some fine dry chalk, on a piece of heated iron; cover the chalk with a very fine linen cloth, and thereto apply the under part of the body of the insect: the heat of the iron dissolves the grease, while the chalk absorbs it, and the linen cloth prevents the chalk from clotting to the insect. This process may be repeated several times if the grease is not entirely eradicated by the first attempt. Always observe to exactly attemperate the heat of the iron.

They may be baked in a slack oven, with the

chalk placed to absorb the grease, without any considerable injury to the colours.

Some collectors open the bodies of large moths, take out the entrails, and fill the cavity with fine dry powdered chalk.

MINUTE MOTHS.—TINEA, TORTRIX, ALUCITA, &c.

Much experience, and considerable care, with a light, but steady hand, are necessary for the management of minute moths on the setting-board; it will be equally useless and impossible, to enter into a minute detail of every trivial circumstance that must be attended to: we shall therefore give a general sketch, and leave the rest to the ingenuity of the operator.

First, the fans of the clappers, or forceps, or the fowling-net if you prefer it, must be covered with silk gauze, of a very soft and delicate texture, and as the slightest friction will obliterate the beautiful specklings, or raised tufts that are so profusely bestowed by the hand of nature on this most elegant tribe of insects, you must be extremely careful when you press on the thorax not to crush it more than you can possibly avoid: or if you have it between the fans of the

forceps, put the pin through the thorax while the creature is confined in that situation.

The next care will be to procure pins of such a degree of fineness, as not to injure or distort the wings of the insect; the smallest sort of lace pins will do very well for most kinds, but there are some so extremely minute that even those would be too coarse. If you have pins made purposely for insects of this kind, let them be about an inch in length, and have them drawn as fine as possible.

When the pin is put through the thorax it must be managed with the greatest dexterity, and be exactly in the centre, as the least variation to either side will break the nerves of the anterior margin of the upper wings, which will immediately start, and can never be replaced in a proper position; if the pin is placed too high, it will sever the head from the shoulders, and by being too low, the under wings also will break off or start from their true position; it may be managed better with the assistance of a magnifying eye-glass.

The braces are to be made of the same form as those which are used for larger insects, only smaller in proportion; and instead of making them of stiff card, or pasteboard, they may be small slips of vellum, or stout paper that has been hot-pressed. You must brace them immediately

after you have put the pin through the thorax, for if they are permitted to stiffen, they cannot be relaxed so well as larger insects.

Minute moths are to be found in winter as well as summer; it would be scarcely imagined, nay reason would deny, did not experience prove, that when the frost is so severe as to entirely subvert the appearance and almost annihilate the existance of all the vegetable productions, within the verge of its influence, myriads of those delicately formed creatures brave the inclement season, and exist securely within those habitations they have the address to construct.

A very skilful entomologist informs us, that having occasion to go into the country when the cold was intensely severe and the snow deep, he collected in a few hours a vast number of minute insects of the *coleoptera*, *hemiptera*, and *lepidoptera* orders; and though his collection was then very considerable, he selected thirteen new species, and among them several which he has never found, but when the weather has been very cold, as at that time.

It is proper to observe, that those insects usually shelter among the moss, and other extraneous matter that grow on the trunks or branches of trees, or beneath the rotten bark. Gather the moss, &c, into a box, or tin canister, and shut it close to prevent the escape of those insects, that

may revive by the warmth; when you have an opportunity to examine them, spread a sheet of writing-paper on the table, and place a lamp, or candle, with a shade of transparent or oiled paper before you, so as to weaken the glare; then separate the moss, and shake it loosely in your hand, and you will perceive many insects fall down on the paper; if they are so minute that by thrusting the pin through the thorax they would be damaged, fasten them with gum-water, or some glutinous varnish, to small slips or pieces of paper.

NEUROPTEROUS, HYMENOPTEROUS, AND DIPTEROUS INSECTS.

Among those of the neuropterous order are included the libellulæ, a most elegant tribe of insects, but very difficult to preserve. The colours on the body are exceedingly brilliant in some species, but inevitably change black within a few days after death, unless the collector is particularly attentive to their preparation.

They are extremely tenacious of life; we have seen one of the larger kinds live two days on the pin, and even show symptoms of life twenty-four hours after being deprived of its head.

The most expeditious method of killing those creatures, is to run a red hot wire up the body and thorax, for they will live a considerable time in agony, if you attempt to kill them with aqua-fortis as before directed for the moth tribe.

After they are dead, clean their bodies on the inside with a little cotton twisted to the end of a wire, and put a roll of white paper into the cavity, or fill it with cotton; in most species this will not only admirably relieve the colours, but preserve them from changing black.

Note. Those kinds only with transparent skins will require this preparation, as the *L.* 4, *maculata*, &c.

Some of the foreign insects of those orders appear to the greatest advantage in spirit of wine, but whenever the usual method will suffice, it should be preferred. They are all to be stuck through the thorax, and observe always to put the pin so far through, that when it is stuck near a quarter of an inch into the cork the feet of the insect may only touch the surface.

The wings are to be displayed with cramps as usual.

APTEROUS INSECTS.

Many kinds may be preserved in spirits, or in the same manner as coleopterous and other insects; but among those we can include very few, if any, of that extensive genus *aranea* (spiders), no method having been hitherto discovered whereby they may be preserved in their natural colours, for however beautiful they may be when alive, their bodies shrivel and their tints become an obscure brown, soon after death; and as the moisture exhales, the size of the body diminishes, very little more than the skin of it remaining when the creature is sufficiently dry to be placed in the cabinet.

Spiders cast their skins several times in the course of their lives; the exuvia would be very acceptable to the collector, if they retained any of the beautiful colours of the living spiders.

To determine whether some species of spiders could be preserved with their natural colours, we put several into spirit of wine; those with gibbous bodies soon after discharged a very considerable quantity of viscid matter, and therewith all their most beautiful colours; the smallest retained their form, and only appeared rather paler in the colours than when they were living.

From other observations it appears, that if you

kill the spider, and immediately after extract the entrails, then inflate them by means of a blow-pipe, you may preserve them tolerably well; you must cleanse them on the inside no more than is sufficient to prevent mouldiness, lest you injure the colours, which certainly in many kinds depend on some substance that lies beneath the skin.

After inflating them, you may either inject them with fine virgin wax, or anoint the skin with oil of spike in which resin has been dissolved, and dry them in some shady place.

Of the largest kinds of foreign spiders, the bodies are the only parts which are liable to shrivel; if they were prepared in this manner, their proper form would be preserved.

In 1792, Dr Withering presented a paper to the Linnæan society, in which he relates the particulars of a new method of preserving fungi, &c; as we have given an account of this improvement with the instructions for the preservation of plants, we shall only observe in this place, that the composition which he has applied with so much success as a preservative of the most perishable tribes of vegetables, may here after prove also an excellent preservative for spiders, and other apterous insects.

THE CABINET.

It is immaterial whether the cabinet is made of mahogany or wainscot; sometimes they are made of cedar wood, but very seldom of deal or any other wood that is soft; the drawers may be from fifteen to thirty inches in length, the same, or nearly the same in breadth, and about two or three inches in depth; the cork with which the bottoms are to be lined, must be chosen as free from cracks as possible, it must be glued into the drawers to prevent its warping, and be filed, or cut very level; the irregularities should be rubbed even with pumice-stone, and the whole surface be perfectly smooth, before the paper is pasted over it; the paper should be of the finest quality, but neither very stout, nor highly sized; the former being liable to turn the points of the pins, and the latter to injure the insects by not readily absorbing the grease, which may flow from them: the top of every drawer must be glazed, to prevent the admission of dust or air; the glass is usually fitted into a frame of the same size as the drawer, and is made either to slide in a groove, or let in on a rabbet. Some collectors wash the cork several times with spirit of wine and corrosive sublimate, to destroy the mites;

and moisten the paper after it is pasted on the cork with alum-water.

Observe that every crevice in the drawers or boxes must be stopped to prevent the admission of external air, and always appropriate a quantity of camphor for each drawer, or the mites will destroy the insects.

If your cabinets or boxes stand in a damp situation, the insect will become mouldy on the antennæ, legs, &c; this must be cleaned off with a camel's-hair pencil, and the cabinets in future be put into some place where they will be less exposed to damp.

If you perceive notwithstanding the camphor, a dusty appearance on the insects, add also a quantity of musk, and clean the dust off with a soft pencil; if after this you find more dust, either bake the insects, or dissolve corrosive sublimate in spirit of wine, and touch the parts that appear dusty with a fine pencil moistened in the liquor, which will destroy the mites that occasion such appearance.

The method which Harris advises promises only to materially injure the insects, or at least change their colours if brilliant, as we have found by experience.

'If at any time the insects in a cabinet or box, where they are placed for preservation, should appear as if growing mouldy, or be infested with

small *animalculæ*, which is known by a kind of dust seen beneath the abdomen; in this case the smoke of tobacco is the only effectual remedy, which must be blown through the small end of a pipe admitted through a hole made for that purpose in the back of the drawer or box; this not only corrects the putrid and stagnant air, but destroys those formidable enemies which often destroy whole cabinets of insects: this will preserve them for twelve months, when it will be necessary to act the same part over again. It may be feared and objected that the smoke may in some measure damage the insects, but a little experience will plainly evince the contrary.'

DESCRIPTION OF THE MUSEUM OF NATURAL HISTORY AT PARIS.

Vallée Suisse and Menagerie. The menagerie of Versailles was transported hither in 1794. It comprises a length of 229 toises, and a breadth of 110. The animals of peaceable habits occupy fourteen divisions, each subdivided into as many compartments as there are different species. Nothing can be more picturesque than what is here exhibited;—a perpetual variation of surface, an unceasing diversity in the apartments which contain the different animals—each one lodged according to his peculiar character,—variety even in the lattices of the chestnut trees which form the enclosure. On entering the Vallée Suisse on the side of the amphitheatre, and taking the alley which winds between the rotunda and aviary, you are struck with the camel *Alpaca*, remarkable for the length and fineness of his hair. In the first enclosure, you see the long-tailed African sheep, the sheep of Morvan with his abundant fleece, the goats of Tartary and India whose hair is manufactured into shawls, a he-goat from Upper Egypt, and others of different parts of Europe. The next enclosure has five divisions, and contains in the middle a circular

cabin. The first division is an immense basin, in which are swimming a multitude of aquatic fowl and tortoises. The four others contain the gallinaceous tribes and shore-birds; the last of all is tenanted by ostriches.

The neighbouring park, which in structure resembles a ruin, contains several species of animals, and a basin for water-fowl. A ruin presenting the appearance of a painted house, offers a retreat to the deer and wild goats that inhabit the next enclosure. Close to this is a rotunda surrounded by pillars, containing a mule of the breed of the zebra. Other divisions are inhabited by divers species of sheep and fallow deer. Between the menagerie of peaceable animals and the garden, are pits which contain three bears and two wild boars. The rotunda in the centre of the menagerie is tenanted by a young elephant, a male and female bison, five dromedaries, a zebra, and other tropical animals. Opposite is a magnificent enclosure, containing pheasants of all countries, even of China. Near these are the birds of prey; among which are the vulture *papa*, given to the Museum by the Duke of Orleans, now Louis Philippe, King of the French,—the condor, the vulture without a tail from Senegal, then the noisy tribe of parrots, and the mimicking race of apes.

Toward the Seine, there was constructed in

1821 a menagerie for ferocious animals; at present its twenty-one apartments contain — a Senegal lion with a faithful dog for his companion, a lioness accompanied by a bitch, a bear with a mane, a male and female wolf, a jackal of Senegal, and an Asturian bear.

Cabinet of Natural History. This occupies the whole of the building of two stories, extending upon a façade of 290 feet beyond the court at the extremity of the garden opposite the Seine. Upon the first floor, are exhibited in a large hall samples or models of all instruments used in agriculture; the remainder of this story serves as a magazine for those objects of Natural History, which are too large to be placed in cabinets. The interior is divided into six rooms on the first floor, and five on the second. The first contain geological and mineralogical collections, reptiles, and fishes; the second are devoted to quadrupeds, insects, and shells.

Geological Collection. The entrance to this temple consecrated to the productions of nature, is indicated by a magnificent column of the basalt of La Tour in the department of Puy de Dome; this column is surmounted by a superb pyramid of rock crystal, 2½ feet in diameter at the base; near this are two other basaltic columns from the

Giant's Causeway in Ireland, and a column of irregular structure from St Sandoux in Puy de Dome. In the first room are to be seen a multitude of stones, bearing the impression of plants and invertebrated animals. Here also is a complete collection of the stones natural to the soil of France. Fossil vegetables are arranged in cabinets on the left, and fossil animals on the right. The second hall has a rich collection of vertebrated animals, illustrating the process of their petrifaction; these occupy two immense glass cases, in the centre of the hall. Fossil fishes are on the right of the entrance,—fossil bones of quadrupeds, birds, and reptiles in cases opposite the windows. Here we are particularly struck with the view of those found in digging the canal de l'Ourcq; we remark also the teeth of the elephants found at Rome, and the skin of the enormous animal discovered in Siberia on the banks of the Lena.

The next hall is devoted to a systematic collection of stones, classed according to the nature of their composition and contexture; next are the elements of a geographical collection of stones, both rough and polished. At the left on entering are four superb vases, manufactured from the lava of Vesuvius; a cup of rock-crystal, a large table of green serpentine, and a mirror of talc—such as used by the ancient Peruvians; next are

cups of chalcedony, agate, and jasper of different colours,—one of rock-crystal, another coloured violet by fluate of lime, two of greenish jade, a vase of the same, and a small one of lapis lazuli. In the adjoining cases are small slabs of jasper, agate, and chalcedony; a row of small columns of amethyst; cups of amethyst, chalcedony, and chrysopasus; precious cut stones, diamonds, oriental rubies, sapphires, chrysolites, &c. There is also another collection of precious stones polished, and rock-crystal variously coloured according as the light is reflected by its facets. To these are added a collection of precious stones of artificial construction. Next are seen a miscellany of divers substances, among which are—an elegant specimen of amber, an immense slab of Florence marble, savage tomahawks, a cup of red marble, and a large spoon of green jade.—These last articles are splendid beyond denial, but they must yield in value to the vestiges before mentioned of plants and animals found in regions far distant from their native abode, and thereby constituting natural and irrefragable proofs of the general deluge in which they were removed.

Mineralogical Collection. Every thing is scientific in the arrangement of this collection,—where the mineral substances are disposed accord-

ing to their constituent elements, after the system of the celebrated Hauy. The numerous specimens here assembled, form by no means the least ornament of the museum even to the eyes of the uninstructed,—to whom their scientific denominations offer for the most part an inexplicable enigma. Some objects are particularly striking; such as a superb vase of porphyry from Vosges, and large groups of crystals coloured by quartz. A second hall contains inflammable substances and metals; here is a superb group of transparent crystal—diamonds in every state—bitumens liquid and solid—portions of amber containing insects—platina—a mass of native gold from Peru, weighing 64 ounces—a magnificent specimen of native silver from Mexico—various combinations of silver with sulphur, antimony, muriatic and carbonic acid; here is to be remarked the great diversity of colours assumed by mercury in its combinations with different metals; here is also a large collection of *aerolites*, or meteoric stones. Six cabinets contain magnificent specimens of iron. Other metals are in great abundance, but the spectator is now attracted to the adjoining hall by those productions of nature which make a nearer approximation to life.

This apartment is embellished with a collection of rare fruits dried; here are the productions

of the baobab, the cocoa, the bread-fruit, the cinnamon-tree, the bamboo, the banana, &c. One of the most remarkable among these collections, is that of a series of small sheets of wood of every species sawed horizontally and vertically, exhibiting an endless variety of shades and veins.—Here finishes the chain of beings deprived of spontaneous movement; and here begins that immense series of beings endowed with the faculty of locomotion, in which man, gifted with reason, and not subjected to a blind instinct, occupies the highest rank.

Collection of Fishes. This comprises 5000 individuals, and 2500 different species, all preserved with an art which exhibits every exterior form. In the midst of these wonders appears the statue of the celebrated Buffon, whose genius has painted them to us with so much truth; the pedestal bears this inscription,—*Majestati naturæ par ingenium.* The most brilliant part of this division is upon the second floor; this consists first of the

Mammalia, to the number of 15,000, forming 5000 species. The features of these animals designate their instincts; their various faculties are denoted in their mien and bearing; the intelligent spectator remarks how their forms are adapted to

their climate and soil, and to their peaceable or ferocious dispositions. The mockery of the ape, the simplicity of the lamb, the fury of the enraged lion, the agility of the deer and the goat,—these form the most striking contrasts. The visiter is struck with the vast variety exhibited by the ox of different countries,—the vast disproportion between such immense masses of animation as the elephant, and such insignificance of size as the shrewmouse. The mind is overpowered and humbled, to witness the action of creative power in the formation of so many wonders.

Birds. These offer a variety of configuration and colour, no less astonishing than the quadrupeds. Here are 6000 individuals, and 2300 species,—exhibiting every shade and variety of colour, attitude, habit, and manner.

Invertebrated Animals. These amount to 25,000; their beauty and magnificence are truly astonishing. A class of beings almost unshaped, and whose flesh is almost devoid of consistence, yet splendid of hue, and constructing with their own peculiar substances commodious and elegant habitations. The *lepidopteræ* also occupy the same apartment; among these are to be remarked, the beautiful shapes and dazzling colours of the Surinam butterflies, which the splendour of

no diamond can equal. These apartments are embellished with a statue of Venus Urania by Dupaty, and busts in bronze of Linné, Fourcroy, Antoine Petit, Winslow, Tournefort, and Daubenton,—placed amidst the objects which formed the theme of their meditations, and the elements of their renown.

Cabinet of Comparative Anatomy, situated between the *Rue de Seine* and the *Vallée Suisse*. It was begun under the direction of Buffon in 1775, and was perfected by Cuvier, whose profound and observing genius is equally great in the conception and expression of thought. Skeletons of every species of animals are here brought together; in their arrangement, not only is the order of their bony structure observed, but they are compared in relation to the shape and disposition of their various organs, which are preserved by injecting with infinite art all the soft parts. Here is not only a comparison of the human form with animals, but comparisons of the different human races,—as the European with the Tartar, Chinese, Hottentot, negro, native of New Ireland, American savage, Egyptian mummy. Here are to be seen the Hottentot Venus, and Bebe—the famous dwarf of King Stanislas. The six halls which compose this cabinet contained in January 1823, 11,486 anatomical preparations.

The library of the Museum contains 10,000 volumes, upon every portion of Natural History; the herbals of Tournefort and Le Vaillant, and magnificent designs upon vellum by Van Spaendonck and other celebrated artists.

Garden of Plants. This is in three parts; the lower garden, extending from the Seine to the galleries, laid out symmetrically; the upper garden, planted with trees in an irregular manner, appropriate to the surface; and the Vallée Suisse, with its sinuous passages, forming the spaces allotted to the habitations of the peaceable animals and the enclosures in which they feed. Upon entering this part of the Museum, you behold the garden divided lengthways into three parts, by long covered alleys running from the Seine to the galleries,—the wide intervals between them,—the portion of the garden on the left, by the Rue de Buffon,—that on the right, between the main alley and the Vallée Suisse. A coffee-house first meets your view on the left, in a retired shade. Next is a square covered with blooming trees; those of the spring and autumn being in separate divisions. Apart from these, and separated by a transversal alley of Virginian poplars, is a nursery of foreign trees and shrubs; among which are distinguished the beautiful clusters of the Ispahan peach, brought from Persia in 1780. Ornamental

plants occupy the space adjoining; here are found vast varieties of the most beautiful flowers.

Next are the forest trees of different climates, under the shade of which stands a coffee-house; here is seen the interlacing foliage of trees brought from the most distant quarters of the globe; the spectator will remark the juniper of the Levant, which has attained upon the soil of Paris to the height of 40 feet,—the American acacia, and the sophora of Japan.

The space on the river side between the main alleys, is devoted to the culture of medicinal plants, for the use of the poor; next this is a kitchen-garden. Beyond these, and surrounded by a railing, is a nursery of exotic trees,—principally of the resinous species; within this enclosure is a hexagonal building for bee-hives. In the parterres, which extend to the galleries, are contained such plants as retain the stalk beyond the year; here is also a basin, covered with the foliage of aquatic plants, and surrounded during summer with orange and pomegranate-trees.

Farther to the left is the following arrangement:—beginning at the Seine, in the first enclosure is contained all manner of manure; next, the materials proper for the support of fruit-trees; above these are models of ditches, hedges, natu-

ral enclosures, artificial walls for espaliers, grafts of every description—exhibiting the most singular phenomena in their configuration and in the union of different species upon the same trunk, models of plantations, specimens of pruning, &c, &c. These objects form the commencement of a school of 600 species or varieties of fruit-trees natural to the French soil, systematically arranged. The most interesting portion for the study of plants is the botanical garden, the contents of which are arranged after the system of Jussieu. Greenhouses, both hot and temperate, contain through the winter the productions of the tropical climates. Here are to be seen the sugar-cane, tea-plant, indigo-tree, coffee-tree, manioc, the cactus—on which the cochineal insect is nourished, &c.

Proceeding upward between the two old orangeries, you reach the upper garden; on the right a small bank offers an agreeable promenade, and affords an extensive view of the Fauxbourg St Antoine; on the left is a steep hill, covered with firs and other trees; ascending by a plateau laid out in a labyrinth of alleys, the spectator beholds a cedar of Lebanon, which was brought from England by the celebrated Bernard de Jussieu, and planted here in 1734; on the summit is a kiosk, from which the eye of the spectator may expatiate over a great part of Paris, Vincennes,

the course of the Seine and Marne, and the plain of Ivri; at the summit of this elegant kiosk is an armillary sphere, and a detonating sun-dial with the inscription—*horas non numero nisi serenas.*

Going down, the view is struck with a granite column, surrounded at the base by mineral specimens; this is designed as a monument to the celebrated D'Aubenton, who devoted fifty years of his peaceful and laborious life to the study of nature within these precincts. Near this is a dairy, the inscription to which invites the passenger to a frugal repast; it is alike neat and appropriate in Latin and French:—

——— Hic post laborem quies. ——
Hîc secura quies, aër, victusque salubris;
Colle super viridi sunt ova recentia nobis,
Castaneæ molles, pressique copia lactis.

'Asylum of repose; the silent pines spread their shadow over the verdant hill; this lowly roof furnishes eggs and milk, a rustic meal, but pure as the air of these regions.'—If the Swiss dairy of the Jardin des Plantes cannot be called a *chalet*, we have at least evidence that it is the seat of the muses.

Adjoining this stands the building which serves for the lodgings of those belonging to the estab-

lishment, magazines, &c; walking round a pavilion inhabited by the professors, the spectator finds himself in the midst of a parterre, in front of the amphitheatre,—where are placed in fine weather a multitude of superb trees from New Holland, the Cape of Good Hope, and the Barbary coast. The entrance to this elegant amphitheatre, which is appropriated to the study of chemistry, anatomy, and medicine, is adorned with two elegant Sicilian palm-trees twenty-five feet in height; eastward is a magnificent greenhouse, devoted to the results of Captain Baudin's expedition.

The garden was founded by Louis XIII, in 1626; that monarch granted for the purpose a few acres of sterile ground at the extremity of the Fauxbourg St Victor, and an arid bank formerly surrounded by a sewer; upon these were placed a small garden, three professors, and a demonstrator. In making these scanty preparations, he was far from foreseeing in them the foundation of a magnificent temple of the wonders of nature, destined to become one of the first ornaments of the capital, and an honour to France.

GLOSSARY.

As it has never been found possible in works of Natural History—however adapted to popular reading—to divest the language entirely of scientific terms, the following collection of those in general use has been thought necessary. The generical appellations of those tribes of the animal creation with which we have any degree of familiarity, have been included.

Accipitres. The rapacious class of birds.

Alauda. (In ornithology) Genus Lark.

Alca. Gen. Auk.

Alcedo. Gen. Kingfisher.

Ambulatory. A tribe of walking-birds, with three distinct toes before, and one behind.

Anas. Gen. Duck.

Anseres. The class of swimming-birds.

Antenna. The horn of an insect.

Apis. Gen. Bee.

Apodal. An order of fishes with bony gills and no ventral fins.

Aptenodytes. Gen. Penguin.

Apterœ. An order of insects, without wings.

Aranea. Gen. Spider.

Arctomys. Gen. Marmot.

Ardea. Gen. Heron.

Asterias. Gen. Starfish.

Balœna. Gen. Whale.

Belluœ. An order of Mammalia, having obtuse front teeth in each jaw, and undivided hoofs. These are the Horse, Hippopotamus, Tapir, &c.

Bivalve. A shell consisting of two parts, connected by a hinge.

Blatta. Gen. Cockroach.

Bos. Gen. Ox.

Bradypus. Gen. Sloth.

Bruta. An order of Mammalia, entirely destitute of front-teeth. These are the Sloth, Ant-Eater, Rhinoceros, Elephant, and Manati.

Buceros. Gen. Hornbill.

Capra. Gen. Goat.

Caprimulgus. Gen. Goatsucker or Night-Hawk.

Canis. Gen. Dog.

Cardium. Gen. Cockle.

Caruncle. A fleshy protuberance.

Castor. Gen. Beaver.

Catkins. The imperfect flowers or blossoms of certain trees.

Cere. (In birds) the membrane covering the root of the bill.

Certhia. Gen. Creeper.

Cervus. Gen. Deer.

Cetacea. An order of Mammalia, comprising the Whale and Dolphin tribes.

Charadrius. Gen. Plover.

Chrysalis. The first apparent change of the maggot of any species of insect.

Cinereous. Ash-coloured.

Clavicle. The collar-bone.

Clupea. Gen. Herring.

Coleopteræ. The tribe of Beetles, or such as have crustaceous coverings to their wings.

Columba. Gen. Pigeon.

Colymbus. Gen. Diver.

Corvus. Gen. Crow.

Coverts. The *wing coverts* are the feathers lying about the base of the wing.

Crotalus. Gen. Rattlesnake.

Crustacea. An order of animals covered with a calcareous shell, as the Crab and Lobster.

Cryptogamia. A class of plants which have the sexual organs hidden.

Culex. Gen. Gnat.

Cuneiform. Wedge-shaped.

Dasypus. Gen. Armadillo.

Deciduous. Those trees which shed their leaves in autumn, in contradistinction to evergreens.

Delphinus. Gen. Dolphin.

Didelphis. Gen. Opossum.

Digitated. Furnished with fingers or toes.

Diomedea. Gen. Albatross.

Dipteræ. A class of insects with two wings, as the Fly and Gnat.

Dipus. Gen. Jerboa.

Dorsal. On the back.

Elytra. The crustaceous coverings to the wings of the coleopteræ.

Emberyza. Gen. Bunting.

Entomostracea. A tribe of animals inhabiting the water, and which unite the characters of the insect and oyster.

Equus. Gen. Horse.

Erinaceus. Gen. Hedgehog.

Exuviæ. The slough or cast skin of a reptile.

Felis. Gen. Cat.

Ferœ. A class of Mammalia, with six front-teeth in each jaw, and one canine-tooth on each side in both jaws. They are the Seal, Dog, Cat, Weasel, Otter, Bear, Kanguroo, Mole, Shrew, and Urchin.

Filiform. Thread-shaped.

Formica. Gen. Ant.

Fringilla. Gen. Finch.

Gadus. Gen. Cod.

Gallinacea. A class of birds akin to the domestic fowl; as the Pheasant, Turkey, Peacock, Bustard, Pintado, and Grous.

Glires. A class of Mammalia with two long front-teeth in each jaw, and no canine-teeth. These are the Porcupine, Cavy, Beaver, Rat, Marmot, Squirrel, Dormouse, Jerboa, Hare, and Hyrax.

Grallœ. The tribe of wading-birds.

Gressorial. A term applied to the feet of a tribe of walking-birds which have the fore-toes connected, but without a membrane.

Gryllus. Gen. Locust.

Helix. Gen. Snail.

Hemipterœ. A tribe of insects with wings half crustaceous, half membranaceous; as the Cockroach and Locust.

Hirundo. Gen. Swallow.

Histryx. Gen. Porcupine.

Hymenopterœ. A class of insects with four membranaceous wings; as the Bee and Wasp.

Invertebrated. Without a back-bone.

Irides. The coloured rings of the eyeball.

Lacerta. Gen. Lizard.

Lanius. Gen. Shrike.

Larus. Gen. Gull.

Larvæ. A term applied to the second state of all insects, except those of Moths and Butterflies.

Lepidopterœ. An order of insects with four wings covered with fine scales, apparently like powder or meal; as the Butterfly and Moth.

Lepus. Gen. Hare.

Lichen. Gen. Moss.

Limax. Gen. Slug.

Lithophyte. Stone tree, or coral.

Lobated. (In ornithology) Having the toes furnished with a slitted membrane.

Lore. A bare streak on the head of a bird, from the beak to the eye.

Loxia. Gen. Grosbeak.

Lutea. Gen. Otter.

Macropus. Gen. Kanguroo.

Mammalia. That class of animals which suckle their young.

Mandible. The jaw, or bill.

Meleagris. Gen. Turkey.

Molluscœ. A class of fishes comprising nearly all the testacea.

Monodon. Gen. Narwal.

Motacilla. Gen. Warbler. This genus comprises the Nightingale, Redbreast, Wren, &c.

Muræna. Gen. Eel.

Mus. Gen. Rat.

Musca. Gen. Fly.

Muscicapa. Gen. Flycatcher.

Myoxus. Gen. Dormouse.

Mytilus. Gen. Muscle.

Neuropterœ. A class of insects with four membranaceous, transparent, naked wings, in which the membranes cross each other so as to appear like network; such as the Dragon-Fly.

Numidia. Gen. Pintado or Guinea-Hen.

Ocellated. Marked with spots resembling little eyes.
Otis. Gen. Bustard.
Ovis. Gen. Sheep.

Papilio. Gen. Butterfly.
Palpæ. The feelers of an insect.
Passerine. An order of birds comprising those which sing.
Pavo. Gen. Peacock.
Pecora. An order of Mammalia without front-teeth in the upper-jaw, with cloven-hoofs, and ruminant. They are the Camel, Musk, Deer, Giraffe, Antelope, Goat, Sheep, and Ox.
Pectinated. Shaped like a comb.
Pericarp. The rind of a fruit.
Phœnicopterus. Gen. Flamingo.
Phalæna. Gen. Moth.
Phanerogamia. An order of plants which have the sexual parts distinct.
Phasianus. Gen. Pheasant.
Phoca. Gen. Seal.
Physeter. Gen. Cachalot, or Spermaceti Whale.
Picus. Gen. Woodpecker.

Pies or *Picæ*. An order of birds containing the Crow, Woodpecker, Parrot, Cuckoo, Kingfisher, &c.

Pinnated. The feet of a bird are said to be pinnated when the toes are separate, but furnished with lateral membranes.

Plotus. Gen. Darter.

Pollen. The fecundating dust of a flower.

Primary. The *primaries*, or *primary feathers* of a bird, are the outer feathers of the wing.

Primates. The first order of Mammalia, according to Linné; they have four front-teeth in each jaw, and one canine-tooth on each side in both jaws. The principal animals of this order are the Ape, Lemur, and Bat.

Procellaria. Gen. Petrel.

Process. A fleshy or corneous protuberance.

Psittacus. Gen. Parrot.

Psophia. Gen. Trumpeter.

Pulex. Gen. Flea.

Pupa. The chrysalis of an insect.

Rallus. Gen. Rail.

Ramphastus. Gen. Toucan.

Rana. Gen. Frog.

Rapacious. An order of land-birds, consisting of Vultures, Eagles, Hawks, and Owls.

Rufous. Of a dark reddish colour.

Scapulars. The shoulder-feathers of a bird.

Scarabæus. Gen. Beetle.

Sciurus. Gen. Squirrel.

Scolopax. Gen. Snipe.

Scolopendra. Gen. Centipede.

Scomber. Gen. Mackerel.

Scoria. The dross of volcanic matter.

Secondaries, or *secondary feathers,* are the middle feathers of the wing.

Semipalmated. Partially webfooted, or with a membrane only at the base of the toes.

Setaceous. Bristly; covered with coarse hairs.

Simia. Gen. Ape.

Sitta. Gen. Nuthatch.

Speculum. A coloured, shining spot, upon the back of the wing.

Squalus. Gen. Shark.

Strix. Gen. Owl.

Struthio. Gen. Ostrich.

Sturnus. Gen. Stare, or Starling.

Subcaudal. The *subcaudal* feathers are those which lie under the tail.

Subulate. Curved in the shape of a shoemaker's awl.

Talpa. Gen. Mole.

Tarsus. (In a bird) The leg, or the bone between the thigh and the claw, in the popular sense.

Tentacula. The feelers of an insect.

Tertiaries, or *tertiary feathers*,—the interior feathers of the wing, or those next the body.

Testacea. A class of animals covered with a hard shell; as the Tortoise, &c.

Testudo. Gen. Tortoise.

Tetrao. Gen. Grous.

Thorax. The breast-bone.

Trichechus. Gen. Morse.

Tringa. Gen. Sandpiper.

Trochilus. Gen. Humming-Bird.

Turdus. Gen. Thrush.

Univalve. A shell complete in a single piece.

Ursus. Gen. Bear.

Vent. (In birds) The under part of the rump.

Vespa. Gen. Wasp.

Vespertilio. Gen. Bat.

Viverra. Gen. Weasel.

Waders. A class of birds comprising the Heron, Plover, Snipe, and Sandpiper.

Wattles. The loose red flesh hanging about the neck of the Turkey, and some other birds.

Xiphias. Gen. Swordfish.

Zoophyte. A substance partaking of the nature of both animal and vegetable.

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